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ABSTRACT

This is the third of three volumes of a safety guide developed to assist Kansas administrators and teachers in organizing, evaluating, and maintaining safety programs. It provides information to help them identify, assess, and correct unsafe conditions relating to equipment and facilities and ensure a safe and healthy environment for themselves and students. The guide delineates areas to be considered in designing effective, ongoing safety awareness programs and provides technical information regarding the systematic development of those programs. Instruments for self-evaluation, reporting, and record keeping are included for assessment purposes. This volume addresses these topics: (1) portable power equipment (small appliances, industrial portable power equipment), (2) hand-held tools and utensils (hand tools for elementary school use, hand-held tools and utensils for secondary school use, tools and utensils, scientific implements), (3) compressed air and compressed gas equipment, (4) personal protective equipment, (5) health and environmental control, (6) hazardous materials, (7) chemicals, (8) fire protection, and (9) school facilities. A bibliography and list of organizations that submitted materials for review are appended. (YLB)

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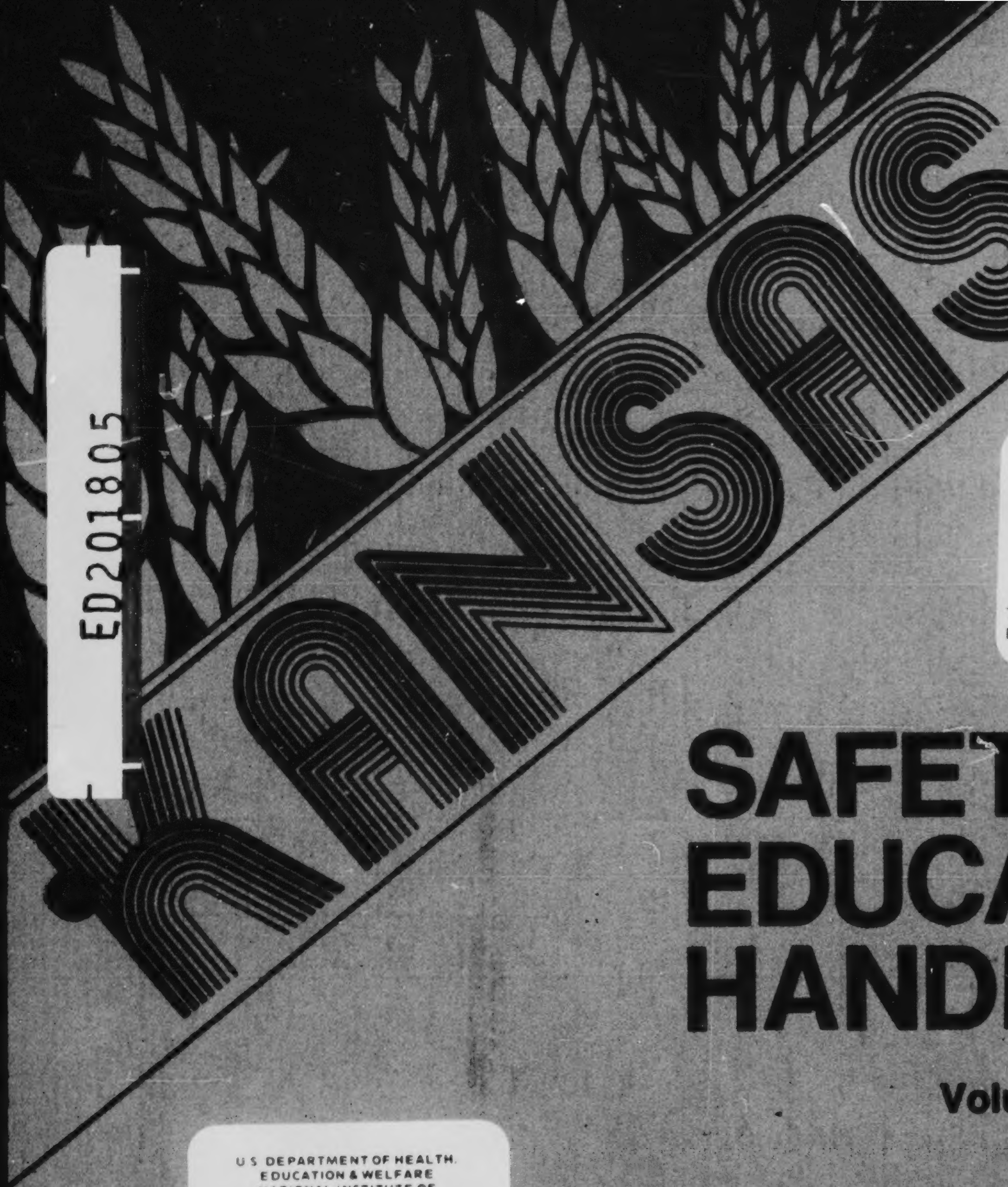

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SAFETY EDUCATION HANDBOOK

Volume 3

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Wichita Area Vo-Tech School
Graphic Arts Center
Wichita Kansas

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Small Appliances: Counter-Top Cooking Appliances

Injuries involving portable electric appliances are similar to injuries associated with traditional pots and pans except that the two inherent features, the electric cord and the heating unit, contribute additional hazards.

The following are descriptions of hazards associated with portable electric counter-top appliances and suggestions for safer selection, use, and maintenance.

Electric Problems

Fires, electrocutions and severe to mild electric shocks. These are caused by:

- defective or worn heating element
- short circuit in appliance or outlet
- overheating the appliance
- overhoading the circuits
- combination of above
- shocks occuring when metal utensils touch heating element

Look for these safety features when selecting:

- UL label
- on-off switch
- thermostat that would shut off
- three-prong, grounded plug

Promote safety while using:

- unplug when not in use, even if they're turned off
- do not overload circuits
- unplug before filling with water
- keep floors and counter-tops around appliance dry
- never insert a metal untensil into appliance

Maintenance:

- replace frayed or worn cords or plugs immediately
- clean according to instruction booklet
- repair damaged or shock producing appliances immediately

Electrical Cord Hazards

Children are principal victims. They pull on or become entangled in cords of appliances and overturn appliance and its contents onto themselves.

Safer use of appliances with cords:

- buy with cords only long enough to reach outlet
- plug in above counter or table level
- never let cord dangle
- do not place high chairs near appliances
- do not use extension cords on appliances

Burns From Hot Surfaces

Dials and handles can become hot enough to cause burns. In some instances the heating element can become exposed to touch. It should be covered or guarded.

- teach children to respect appliances
- keep appliances out of children's reach
- do not use slippery rugs or mats in kitchen
- look for handles that protrude far enough not to become hot
- check handles periodically for secure fastenings

Instability

Can facilitate upsets.

- choose appliances that are stable and sturdily-built
- avoid heavy handles that can shift weight to one side and cause upset
- avoid top-heavy appliances
- check for tops of appliances that fit well
- do not place on unstable surfaces

Grease Hazards

Grease can ignite or splatter under excessively hot temperatures.

- do not heat pan any hotter than necessary to cook food
- keep cooking utensils away from flammable objects
- use non-flammable curtains in kitchen
- cover with a lid or wire mesh screen to prevent splattering

If fire does occur - DO NOT THROW WATER!!

- turn off and unplug appliance
- toss baking soda on fire
- put a lid over fire
- use a dry chemical fire extinguisher

Small Appliances: Electrical Products

Major hazards associated with electrical products are:

1. Electrical fires - caused by overloads on circuits or by poor electrical connections.
2. Electrical shocks - caused by current flowing through the human body.

What is Electricity?

AMPERE - term for the amount of current which flows through a wire.

VOLT - term for the force which pushes the current along the wire.

OHM - term for the resistance to the flow of current.

WATT - term for electrical power, or rate of using a certain number of amperes pushed by a certain number of volts (watts = volts x amperes).

GROUNDING - a circuit is grounded to limit the voltage of that circuit for safety reasons.

You should always use the third prong when it's found on your appliances: do not break or cut it off. Unfortunately the human body is a good conductor of electrical current and therefore easily completes an electrical circuit by permitting current to pass through the body and into the ground. While some current could still pass through your body if you touch an appliance which has a fault in the normal circuit, most of the current will be carried to the ground by the third wire.

Small Appliances: General Safe Guards to Follow

These basic safety precautions should always be followed when using an electrical appliance whether it is small or major, counter-top or hand held. These precautions will be listed this one time and not repeated for each appliance. Specific safety precautions will be listed separately with each appliance.

1. Read all instructions provided by the manufacturer before using.
2. For hazardous equipment, have a supervisor show you proper operating and safety instructions.
3. Do not immerse electrical element into water unless instructions so specify.
4. Unplug appliance when not in use.
5. Unplug appliance before putting-on or taking-off parts or attachments.

Small Appliances: General Safe Guards to Follow continued

6. Unplug appliance before cleaning.

7. Avoid contact with moving parts.

8. Close supervision is needed when using near children or when a child is operating the appliance.

9. Do not operate appliance with a damaged cord or after it has been dropped or damages.

10. Do not use outdoors unless specified.

11. Always remove cord from wall outlet first, then from the appliance.

12. For hazardous equipment make sure guards are provided and used.

13. Make sure they are properly grounded.

14. When unplugging always grip plug firmly and pull straight out.

15. The use of attachments not recommended or sold by the appliance manufacturer may cause hazards.

16. Always use on a dry, level, heat resistant surface.

17. Do not touch hot surfaces, use handles.

18. Do not use appliance for other than intended use of food preparation.

Small Appliances: Electric Blenders, Mixers, Choppers/Slicers, and Grinders

Contact with the blades, beaters, or cutting edges is the major cause of injuries associated with these appliances. The most frequent accident patterns are:

1. Product defects.

2. Malfunctions.

3. Misuse.

Small Appliances: Electric Blenders, Mixers, Choppers/Slicers, and Grinders continued

Follow these suggestions:

PURCHASING

1. Look for sturdy construction.
2. Should stand firmly and level without danger of tipping.
3. For blender - jar should screw to the collar in the same direction that the blades rotate, or one that has blades contained within the jar.

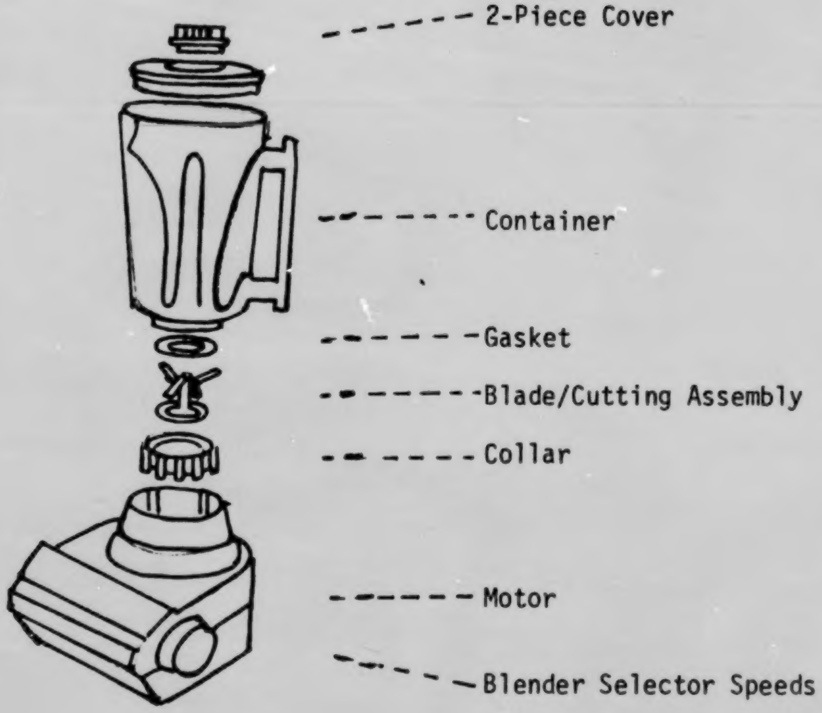
USING

1. Read instruction manuals thoroughly before using.
2. Do not insert or adjust attachments while motor is on or power cord plugged in.
3. Make sure all parts are connected tightly before operating.
4. Keep fingers and hands away from blades at all times.
5. Avoid handling with wet hands or while standing on wet floor.
6. Teach children the dangers.
7. Unplug and store when not in use.

MAINTAINING

1. Disconnect before oiling and cleaning.
2. Keep parts clean.
3. Replace worn cords and plugs.

BLENDER


2-Piece Cover
Container
Gasket
Blade/Cutting Assembly
Collar
Motor
Blender Selector Speeds

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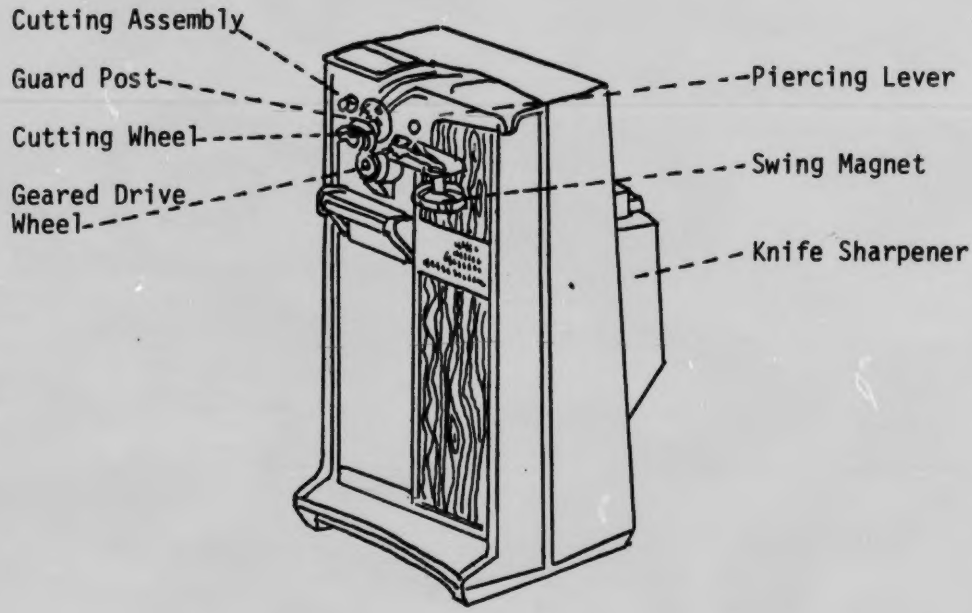
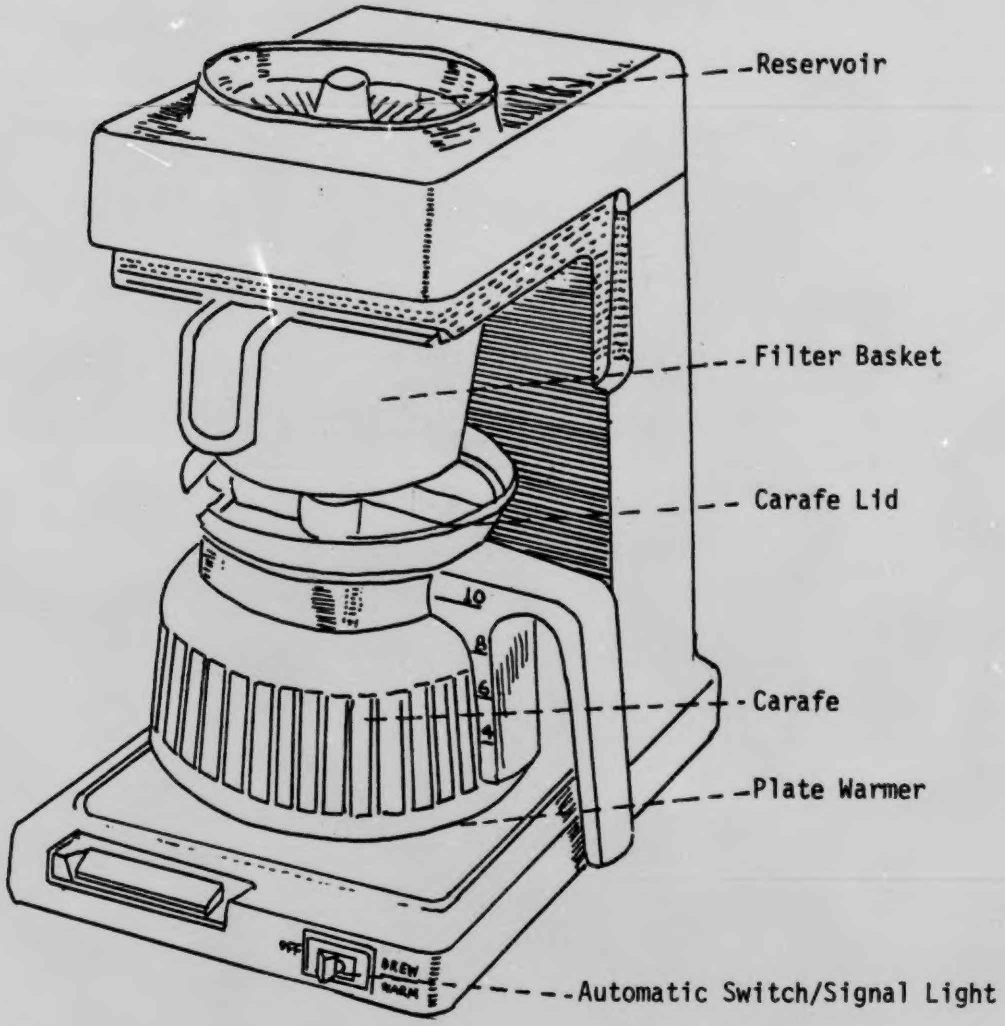
Small Appliances: Can Opener


Cutting Assembly
Guard Post
Cutting Wheel
Geared Drive Wheel
Piercing Lever
Swing Magnet
Knife Sharpener

1. Avoid contacting parts while operating.
2. Do not open pressurized cans or cans of flammable liquids, such as lighter fluids.

Small Appliances: Coffee Maker

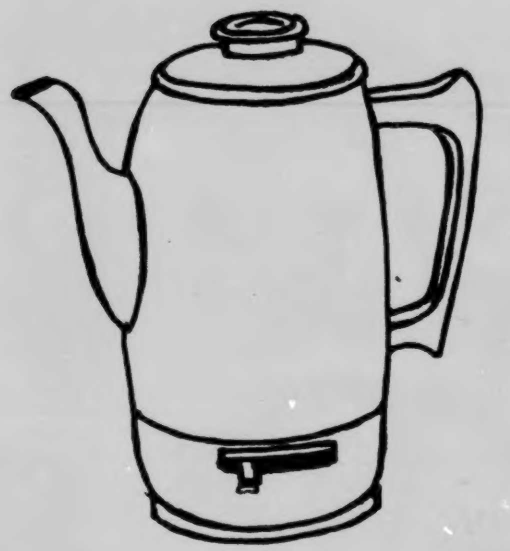

Reservoir
Filter Basket
Carafe Lid
10
8
6
4
Carafe
Plate Warmer
OFF
BREW
WARM
Automatic Switch/Signal Light

1. Do not use other appliances in same electrical receptacle or receptacle on the same circuit with the coffee maker.

2. Do not touch hot surfaces.

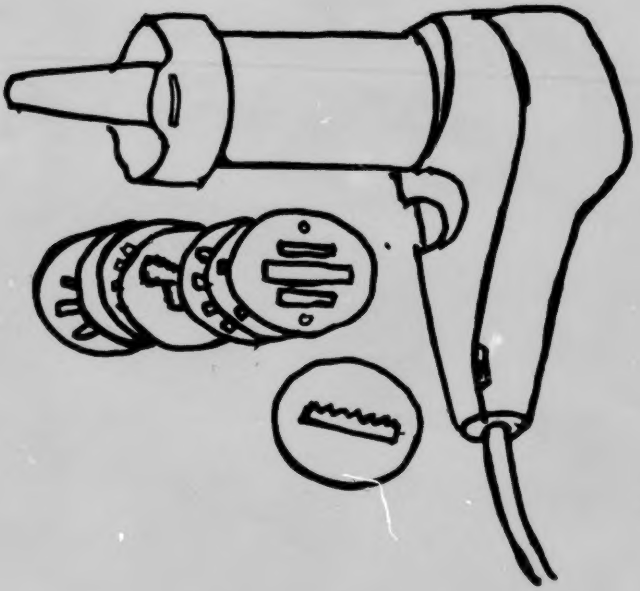
3. Do not place the carafe on electric or gas range surfaces for heating purposes.

COFFEE MAKER



1. Do not allow water to enter base of coffee maker during filling or washing.
2. Never remove lid while coffee is perking.
3. Always make sure there is water in the coffee maker before plugging in.

Small Appliances: Cooky Press/Electric



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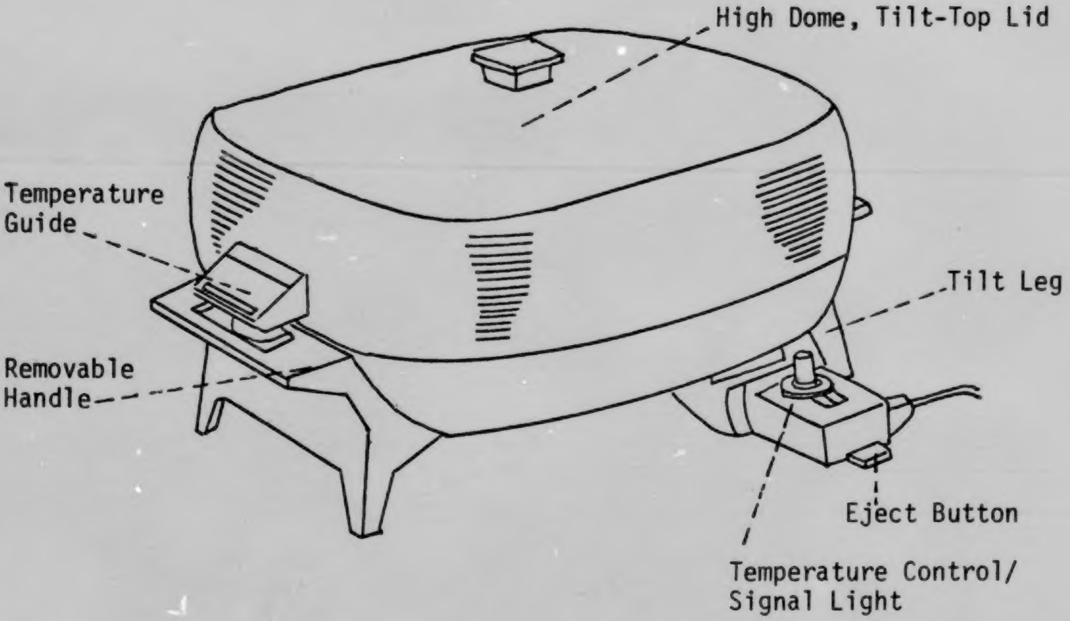
Small Appliances: Electric Skillet

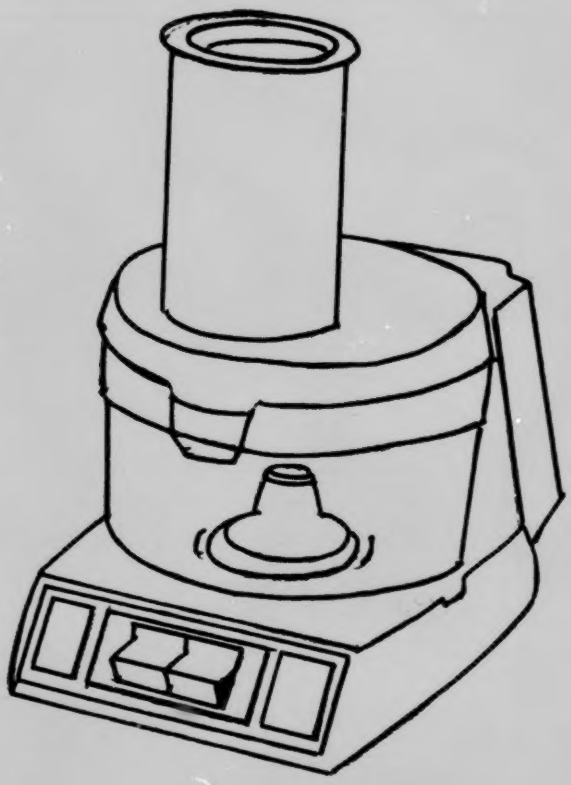

High Dome, Tilt-Top Lid
Temperature Guide
Tilt Leg
Removable Handle
Eject Button
Temperature Control/ Signal Light

1. Avoid spilling water on the temperature control.
2. Remove temperature control before washing skillet.
3. High wattage appliance should not be operated simultaneously with another high wattage appliance connected to the same circuit.
4. When removing lid from skillet, be careful to avoid spilling the moisture accumulation into foods that should be dry such as cake.
5. Let cool before washing.

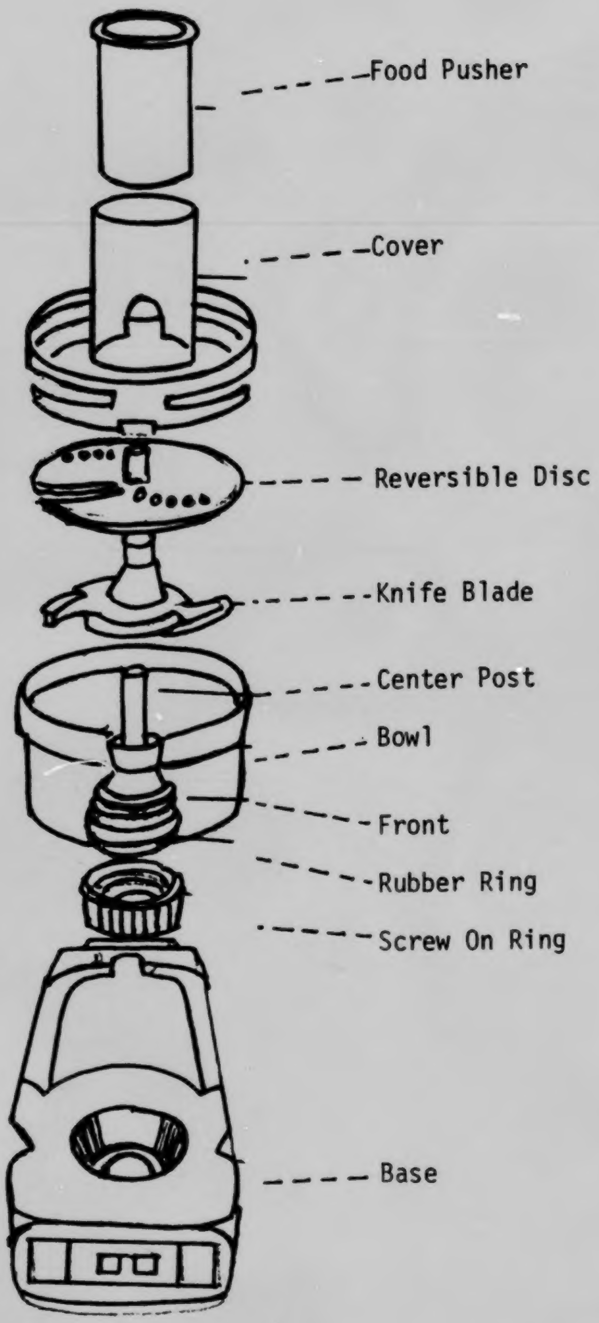
Small Appliances: Food Processor

SAFETY PRECAUTIONS

1. After processing, allow the blade or disc to stop rotating before opening.
2. Always remove the blade from the processor before emptying food from bowl.
3. When washing blade in dishwasher, do not place in silverware basket - someone could get cut seriously when removing.
4. If washing blade by hand, grasp by center hub and use a nylon bristle brush to remove food particles.
5. Press down lightly on food with Food Pusher. Heavy pressure will not speed up the operation.

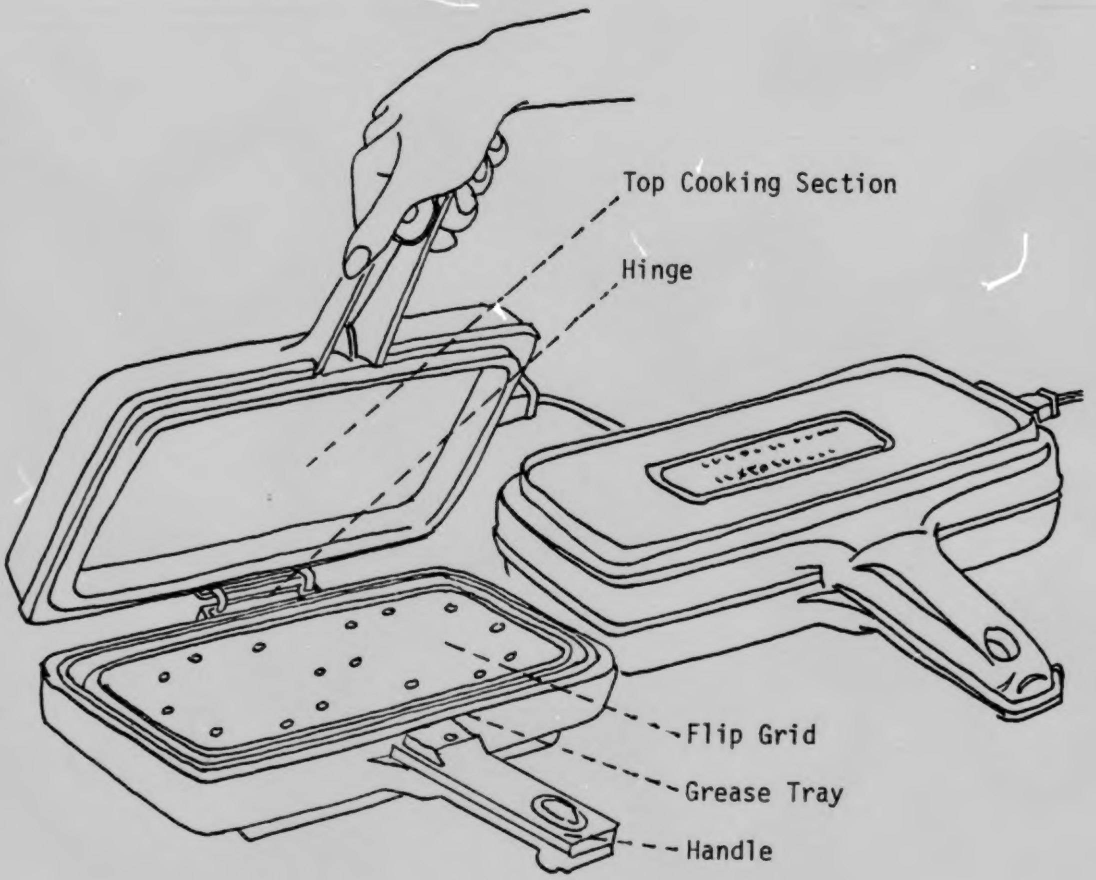


FOOD PROCESSOR

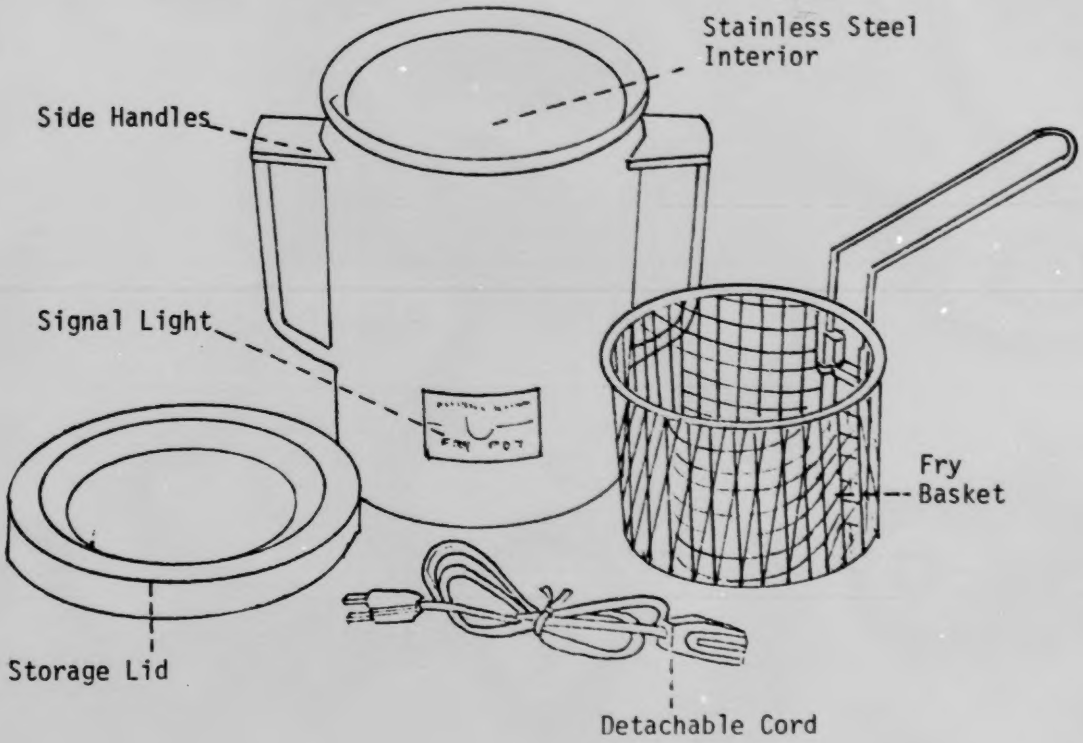

Food Pusher
Cover
Reversible Disc
Knife Blade
Center Post
Bowl
Front
Rubber Ring
Screw On Ring
Base

Small Appliances: Frank-n-Burger Grill

1. Allow to cool before putting on or taking off parts, and before cleaning.
2. Practice extreme caution when moving an appliance containing hot oil or other hot liquids.
3. Care should be taken when removing or turning reversible flip grid.
4. Practice caution when disposing of hot grease or when moving grease tray.
5. Position at least one inch away from wall or rear of counter.


Top Cooking Section
Hinge
Flip Grid
Grease Tray
Handle

Small Appliances: Fry Pot


Stainless Steel Interior
Side Handles
Signal Light
Fry Basket
Storage Lid
Detachable Cord

1. Do not place on or near a hot gas or electric burner, or in a heated oven.

2. Extreme caution must be used when moving deep fryer containing hot oil or other hot liquids.

3. Do not operate in the presence of explosive and/or flammable fumes.

4. This appliance is intended for household use ONLY and not for commercial or industrial use.

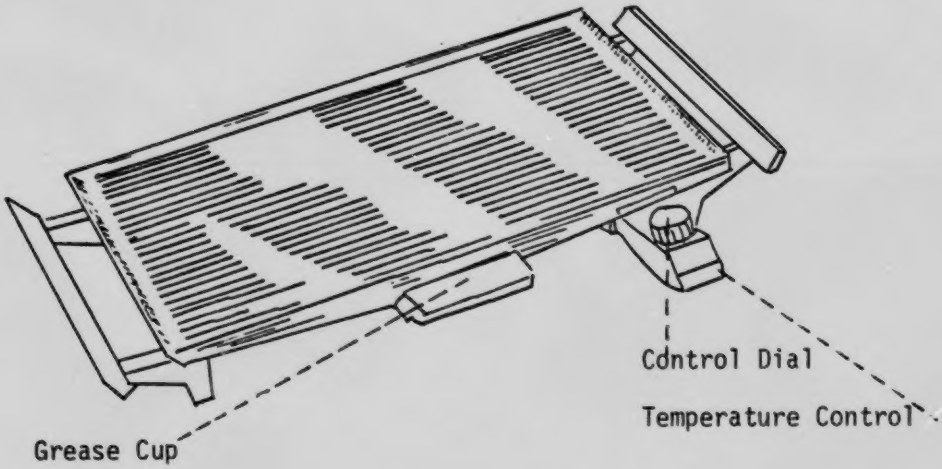
5. When oil is heated to high temperatures, flammable gases are given off. Do not expose a flame to these gases.

6. Never cover deep fryer when heating oil.

Fry Pot continued

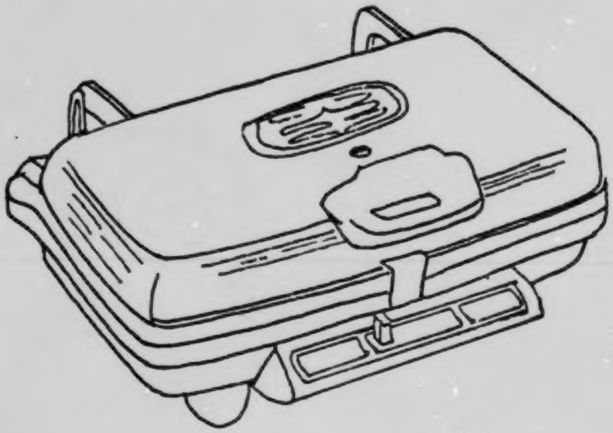
7. If oil darkens or smokes, discard and use fresh oil.
8. Use care not to overload.
9. Fill with vegetable oil to Fill Line only
10. Use only good quality vegetable oil.
11. Do not use butter, bacon fat, lard, margarine, or olive oil since these tend to smoke and/or burn easily.

Small Appliances: Griddle



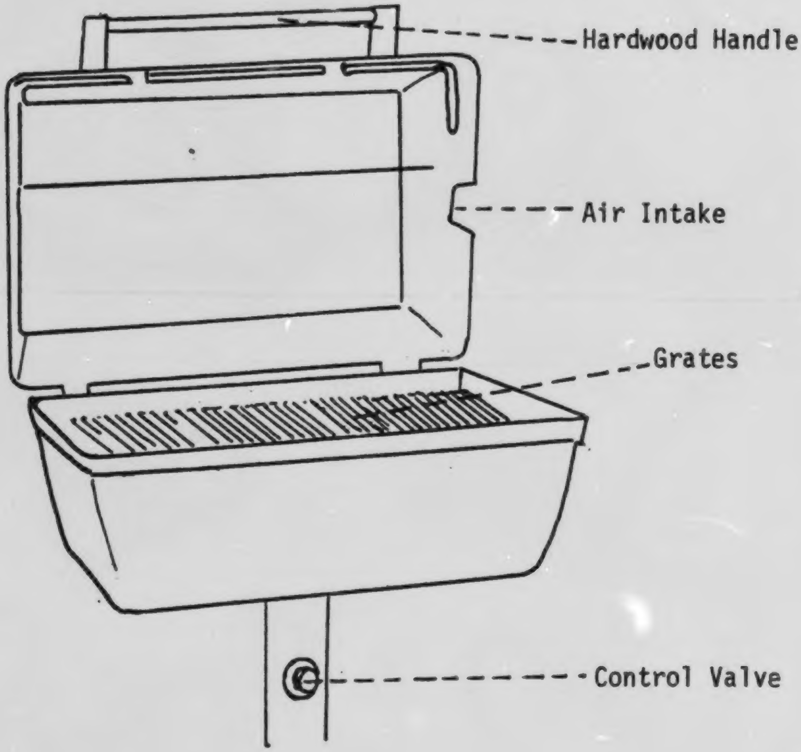
1. Care should be taken not to touch hot surfaces during or immediately after use.
2. When metal type scouring pads or cleaners are used from griddle, make sure no residue is left in the element area where the temperature control is inserted.
3. Empty grease cup often.

Small Appliances: Grill and Waffle Baker



1. Care should be taken when reversing grids not to drop them on the interior parts of the unit.

Small Appliances: Grill/Outdoor Gas

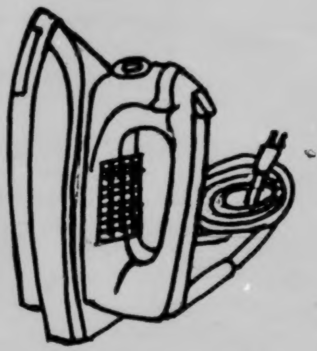

Hardwood Handle
Air Intake
Grates
Control Valve

1. Clean grates immediately after use with a mild detergent in warm water.
2. Always light with the top open.
3. Clean grease cup after each use.
4. Preheat the coals before cooking any food.

Small Appliances: Irons

The following represent hazards associated with irons.

1. Pulling or tripping on the cord, causing hot iron to fall and burn someone.
2. Knocking over the iron causing burns by the hot water spilling or by the hot face of the iron itself.
3. Risks of children climbing on chair and touching the iron.
4. Risks of being hit by the iron if it is pulled off the ironing board or a shelf.
5. Risks of electric shock if water spills on parts carrying the current.



Iron Selection

1. Buy an iron with a cord which can be moved in order to accommodate left or right-handed people.
2. Choose an iron with a wide resting base.
3. For steam irons, choose one with a large, easy to fill water opening.

Iron Use

1. Always unplug when not in use and put out of reach of children.
2. Use a sturdy ironing board, and place it as close to wall and an outlet as possible.
3. Use the proper temperature setting for the fabrics you are ironing.
4. Unplug steam iron when filling it with water.
5. Use demineralized or distilled water in steam irons.

Iron Use continued

6. After ironing, coil the cord and put iron high up to cool.
7. An iron is a high amperage and therefore needs an extension cord capable of carrying that current.

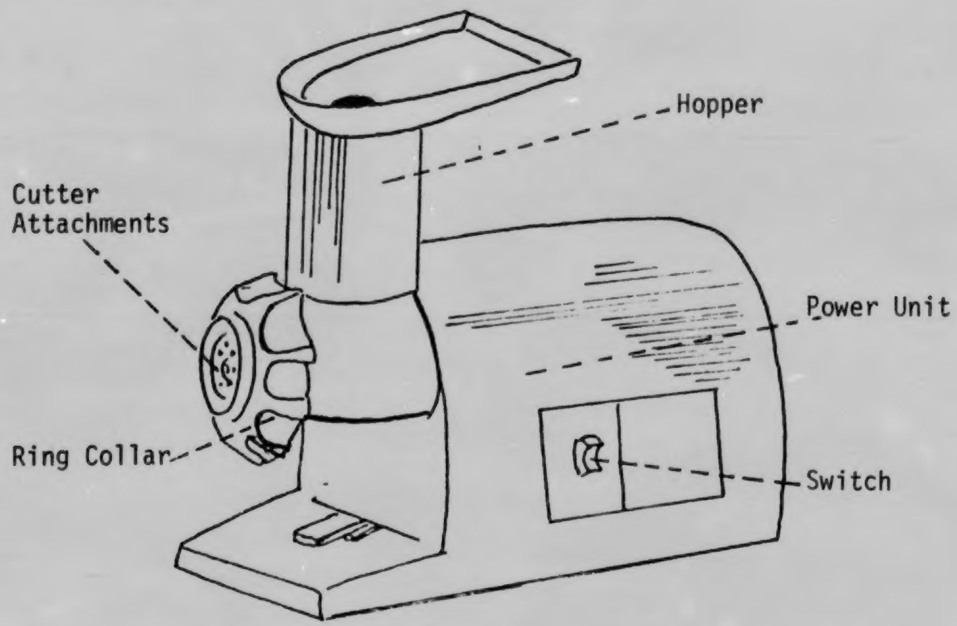
Iron Maintenance

1. Have frayed cords repaired or replaced immediately.
2. If water in steam iron leaks, have iron repaired or replaced.

Iron Storage

1. Be sure water is emptied from iron.
2. Be sure iron is cool before putting away.
3. Coil the cord so it is out of the way.

Small Appliances: Meat Grinder/Food Chopper


Hopper
Cutter Attachments
Power Unit
Ring Collar
Switch

1. Never feed food by hand. Always use food pusher.

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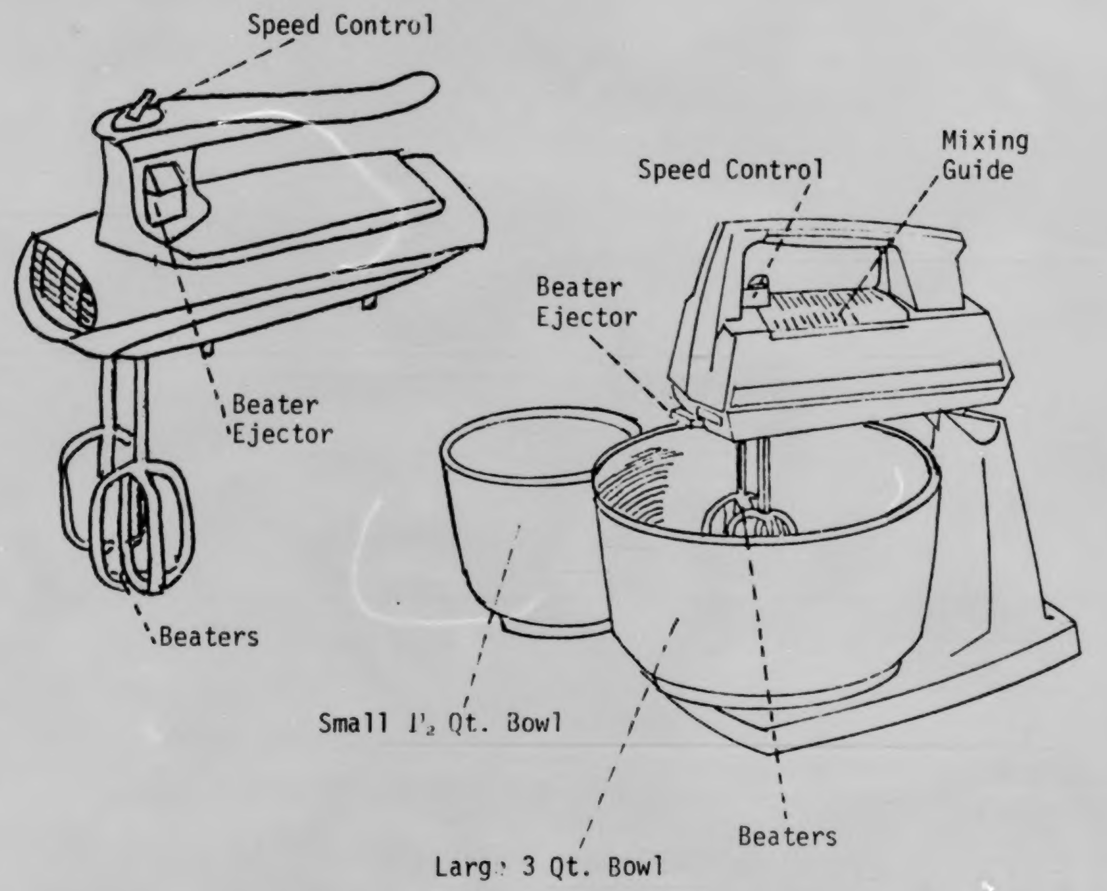
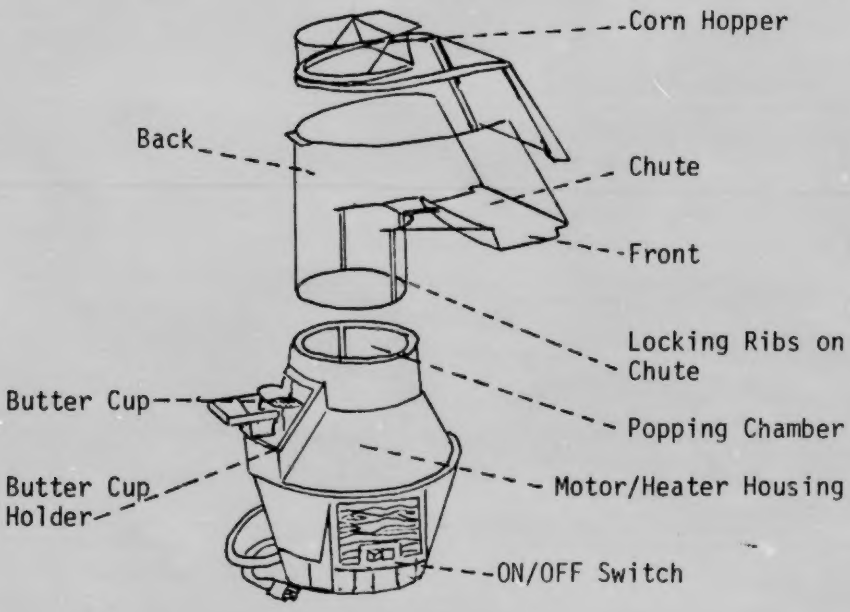
Small Appliances: Mixers


Speed Control
Beater Ejector
Beaters
Speed Control
Mixing Guide
Beater Ejector
Small 1½ Qt. Bowl
Large 3 Qt. Bowl
Beaters

1. Keep hands, hair, clothing, as well as, spatulas and other utensils clear of and away from beaters during operation to prevent injury and/or damage to the mixer.
2. Remove beaters from mixer before washing.
3. Avoid touching the metallic upper stem portion of dough hooks and beaters as they become warm with use and may cause burns.
4. Mixing flammable non-food substances may be hazardous.
5. To attach beaters or dough hooks, have motor turned OFF.

Small Appliances: Pop Corn Popper


Corn Hopper
Back
Chute
Front
Locking Ribs on Chute
Butter Cup
Popping Chamber
Butter Cup Holder
Motor/Heater Housing
ON/OFF Switch

1. Do not use oil in this popper.
2. Allow to cool before putting on or taking off parts.
3. When popper is turned on and operating, it should have the chute in place and should not be left unattended.

Small Appliances: Pressure Cookers

High pressure and temperatures can be dangerous. The following hazards are associated with pressure cookers.

1. Forcing open the pressure cooker-the steam can rush out and burn you.
2. Opening the pressure cooker when it registers low pressure-often occurs when people try to add more ingredients shortly after cooker has been pressurized.
3. Not reading instructions and not knowing how to operate a pressure cooker properly.
4. Misaligning handles can permit hot liquit to escape once pressure builds inside the cooker.
5. Carrying the cooker. It is dropped because of its heaviness and the scalding liquids are spilled.

Follow these suggestions:

PURCHASING

1. Look for emergency pressure relief device in addition to regular pressure relief valve.
2. Look for audible pressure control or a pressure quage that shows precise pounds per square inch and a visible plunger that shows whether cooker is still pressurized.
3. If buying a large model, make sure it has handles on both sides for better carrying.

USING

1. Do not open until all internal pressure has been released.
2. Certain foods sputter and clog steam vent. Do not cook these foods.
3. Do not overfill.
4. When normal operating pressure is reached, turn the heat down.
5. If necessary to open after cooking has started, let all pressure dissipate first.
6. Carry the cooker with mitts or pot holders.

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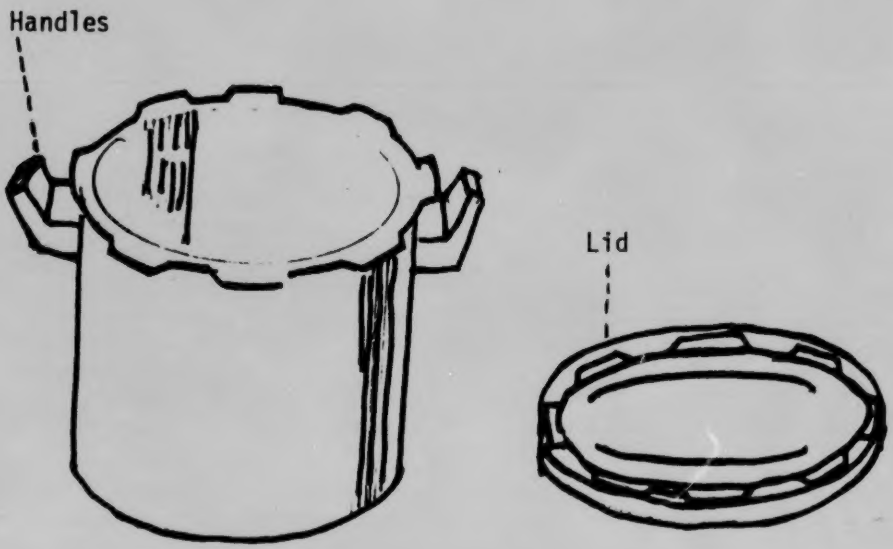
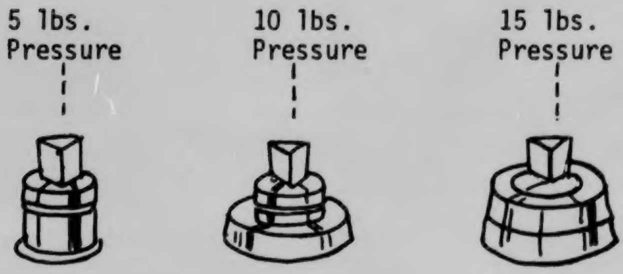
MAINTAINING

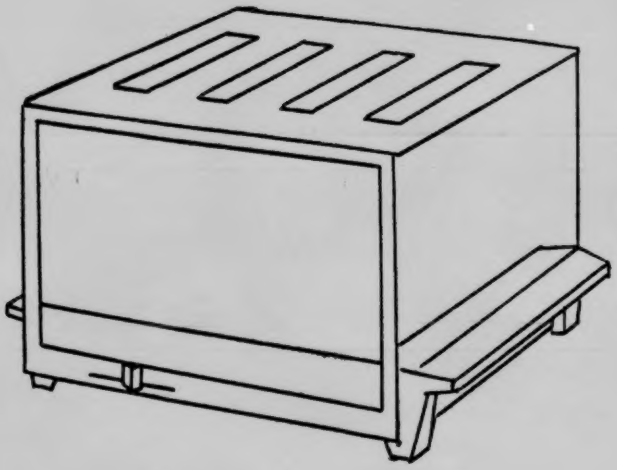
1. Keep vent pipe clean
2. Tighten or replace any loose, or charred handles.
3. Replace gasket when it begins to crack and lose its shape.

PRESSURE COOKERS


Handles
Lid

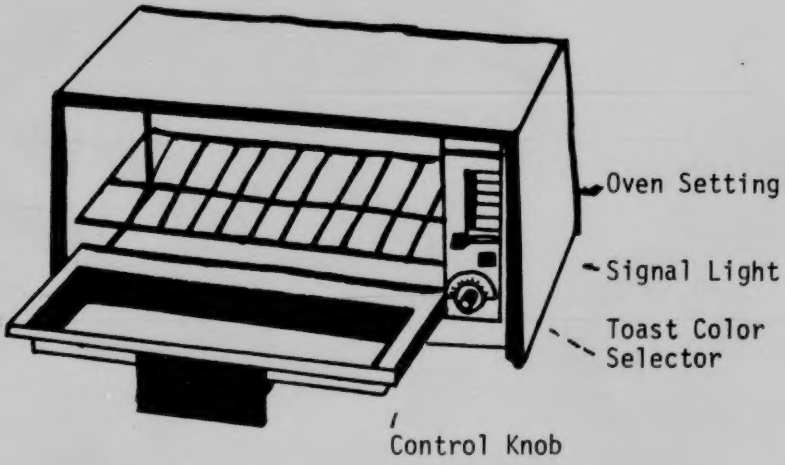

5 lbs. Pressure
10 lbs. Pressure
15 lbs. Pressure

Small Appliances: Toaster



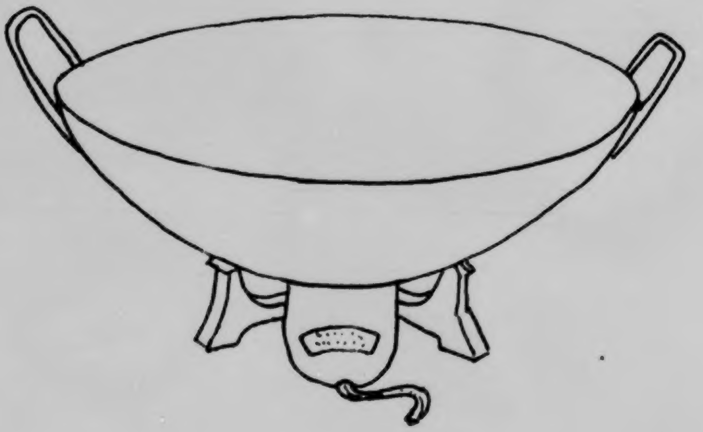
1. Do not touch hot surfaces. Use handles or knobs.
2. Position appliance at least one inch away from wall, or rear of counter.
3. Do not insert oversize foods, metal foil packages, or utensils in a toaster.
4. Do not attempt to dislodge food when toaster is plugged in.

Small Appliances: Toaster Oven


Oven Setting
Signal Light
Toast Color Selector
Control Knob

1. Do not clean with metal scouring pads.
2. Position appliance at least one inch away from wall or rear of counter.
3. Remove cardboard lids on food containers and replace with aluminum foil.
4. Oversize foods or utensils must not be placed in appliance as they might create a fire or electrical hazard.
5. Sealed container must be vented by piercing or partially opening before placing in oven to allow for expansion during heating.
6. Do not use spray-on or other oven cleaners as they may cause electrical damage.

Small Appliances: Wok



1. Use extreme caution when moving an appliance containing hot oil or other hot liquids.

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

Faberware, Electric Wok Set, Instruction Book.

General Electric, Automatic Coffee Maker, Use and Care Book.

General Electric, Frank-n-Burger Grill, Use and Care Book, Pub. No. 5045101-0.

General Electric, Fry Pot Deep Fryer, Use and Care Book, Pub. No. 57C131185, Revision 3.

General Electric, Food Processor, Use and Care Book, Pub. No. 57A600057, Revision 3.

General Electric, Grill and Waffle Baker, Model Type G44, Use and Care Book

General Electric, Pop Up Toaster, Use and Care Book, Pub. No. 4082701-0.

General Electric, Steam and Dry Iron, Model F60, Use and Care Book, Pub. No. 81-6207.

General Electric, Super Deluxe, Portable Mixer, Model M-47, Pub. No. 61-6005.

Rival, Portable Electric Meat Grinder and Food Chopper, Model 2105, Oweners Manual.

Rival, Slimline Can Opener, Instruction Book, Model 740.

Scovill, How To Use and Care for Your Hamilton Beach Blender, Form 2465-HB.

Sunbeam, Fry Pot, Use and Care Book, C313-0943.

Sunbeam, Large MixMaster, Use and Care Book, B1003-2153.

United States Consumer Product Safety Commission, Counter Top Cooking Appliances (Portable), Fact Sheet No. 69.

United States Consumer Product Safety Commission, _Electric Blenders, Mixers, Choppers/Slicers and Grinders_, Fact Sheet No. 50.

United States Consumer Product Safety Commission, _Electric Irons_, Fact Sheet No. 76.

United States Consumer Product Safety Commission, _Pressure Cookers_, Fact Sheet No. 64.

INDUSTRIAL PORTABLE POWER EQUIPMENT

Many hand-held, portable power tools are used daily in most public schools. Chances of a mishap will be lessened if the pupil is taught the correct and safe operation of these power tools.

The Occupational Safety and Health Administration General Industry Standards state:

1. The school is responsible for the safe condition of the tools and equipment used by its employees, including the tools and equipment which may be furnished by the employees.

2. Most hand-held electrical tools must be equipped with a "dead-man" or "quick release" control so that the power is shut off automatically whenever the operator releases the control.

3. All hand-held electrical tools must either be of the double insulated type and be identified as such, or have their frames grounded.

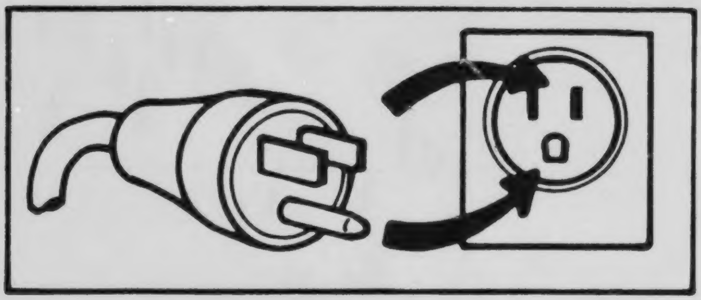
4. Portable circular saws must be equipped with guards above and below the base plate or shoe. The lower guard must retract when the blade is in use and automatically return to the guarding position when the tool is withdrawn from the work.

GROUND INSTRUCTIONS

Electrical hand tools (excluding the double insulated ones) must be grounded while in use to protect the operator from electrical shock. The tool should be equipped with an approved three-conductor cord and three-prong grounding-type receptable. The green conductor in the cord is the ground wire. The green wire must never be connected to a live terminal.

FREQUENTLY VIOLATED REGULATIONS

1. All tools must be used with the appropriate shields, guards, and attachments and be in accordance with the recommendations of the manufacturers. Employees/pupils must be trained in the use of power tools and safety requirements.



2. The rated load of all jacks must be permanently marked on each jack.

3. Jacks must be inspected at least once every six months.

4. Jacks must be appropriately blocked or cribbed when it is necessary to provide a firm foundation.

5. Pneumatic power tools must be positively secured to the hose to prevent the tool from becoming disconnected. Also, a tool retainer must be used on tools to prevent the attachment from being expelled.

6. Nailers, staplers, and similar equipment with autofeed should have a muzzle to prevent the tool from ejecting material unless the muzzle is in contact with the work surface.

WARNING: UNDER NO CIRCUMSTANCES SHOULD ONE REMOVE THE GROUNDING PRONG OF A PLUG. Many people have been electrocuted by hand-held electrical portable tools that were improperly grounded.

ELECTRICAL CORDS

1. Only three-wire extension cords which have three-prong grounding-type plugs and three-hole receptacles which accept each type of plug are to be used.

2. All damaged and frayed cords must be replaced.

3. A tool is not be be carried by its electrical cord.

4. An electrical cord should never be yanked to disconnect the plug from the receptacle. The plug only should be pulled.

5. The electrical cord should be kept from heat, oil, and sharp edges.

6. Use only electrical extension cords suitable for use and so marked whenever a tool is used outdoors.

7. All extension cords are to be used only temporarily and are not to be connected for permanent use.

8. Precautions are to be taken to make sure the electrical cord cannot be fouled during operation of the hand-held tool.

9. The cord plug from the power outlet must be disconnected before making any adjustments or replacing a blade or cutter.

10. Any extension cord must be of 12 gauge wire or heavier for lengths up to 150 feet.

11. Electric cords should be inspected for breaks or exposed wires before using.

12. The electrical switch on the hand-held portable tool must be in the "off" position before plugging in the electrical cord.

13. All electrical cords are to be returned to their proper storage area and in a clean and neat condition.

The table below is based on limiting line voltage drop to five volts at 100% of rated amperes.

When using an extension cord, always use a three-wire cord to permit proper grounding. Be sure to use only outdoor-rated extension cords when using the cord outdoors. Using extension cords of inadequate size wire causes a serious drop in voltage, loss of power, and possible motor damage. As the length of the extension cord increases, heavier gauge cord is necessary.

Before using cords should be inspected and any necessary repairs made. If they cannot be repaired they should be replaced.

Ampere rating (on Nameplate)	0-3	3.1-5.1	5.2-7.5	7.6-10.5	10.6-18.0	18.1-24.0
Ext. Cable Length				Wire Size		
25 Ft	18	18	18	18	16	14
50 Ft.	18	18	18	16	14	12
75 Ft.	18	18	16	14	12	10
100 Ft.	18	16	14	12	10	
150 Ft.	16	14	12	12		
200 Ft.	16	14	12	10		
300 Ft.	14	12	10			
400 Ft.	12	10				
500 Ft.	12	10				

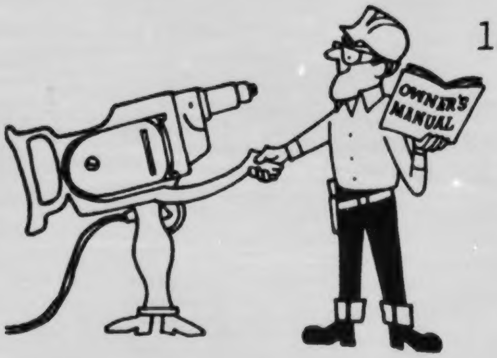
CONNECTING THE TOOL

Some tools are designed for operating on 115 V, 50-60 cycle current only. The rated voltage on the nameplate of each tool should correspond with the power supply.

A tool is not to be used on D.C. current, unless the nameplate indicates that it is an A.C./D.C.

RECOMMENDATIONS FOR THE SAFE USE OF PORTABLE HAND TOOLS

(Provided by: Power Tools Institute, Inc.)



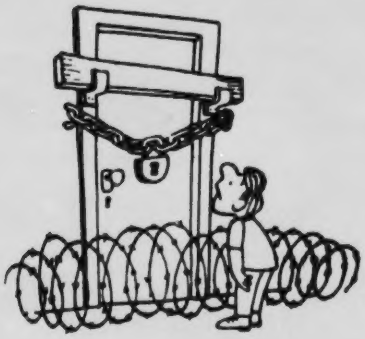
1. KNOW YOUR POWER TOOL--Read and understand the owner's manual. Learn its applications and limitations. Read and understand the labels affixed or included in the shipping container. Keep manuals and labels in safe place for future reference.

2. KEEP WORK AREA CLEAN AND WELL LIGHTED

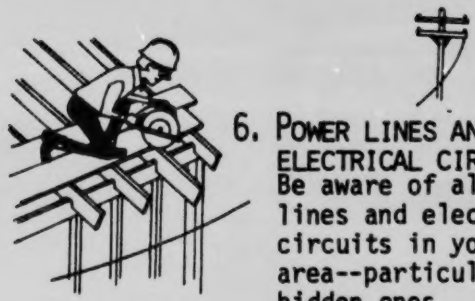
3. **GROUND ALL TOOLS UNLESS DOUBLE INSULATED**--Where a tool is equipped with three-prong plug, it must be plugged into a three hole electric receptacle **KNOWN TO BE GROUNDED**. If an adapter is used to accomodate a two hole receptacle, attach the adapter with a screw **TO A KNOWN GROUND**.

DANGER
FLAMMABLE

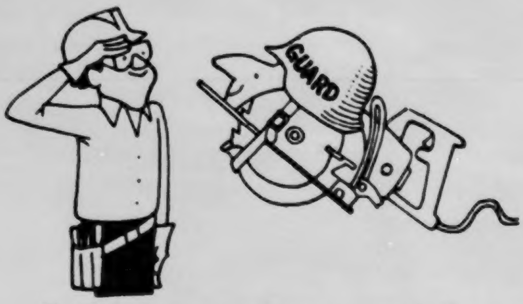
4. **AVOID DANGEROUS ENVIRONMENT**--Do not use power tools in damp, wet and/or explosive atmospheres(fumes, dust or flammable materials).



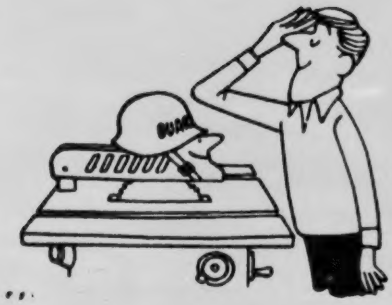
5. **KEEP CHILDREN AWAY**--All observers should be kept at a safe distance from work areas.



6. **POWER LINES AND ELECTRICAL CIRCUITS**--Be aware of all power lines and electrical circuits in your work area--particularly the hidden ones.

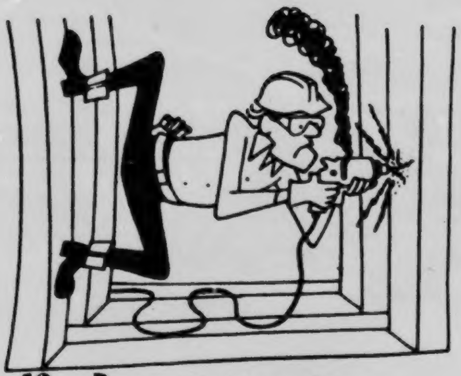


7. **BE ALERT**--Using power tools in tight work areas may put you dangerously close to cutting tools.



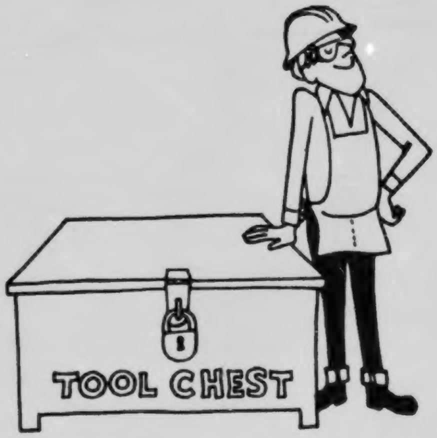
8. **KEEP GUARDS IN PLACE**--And in proper working order.

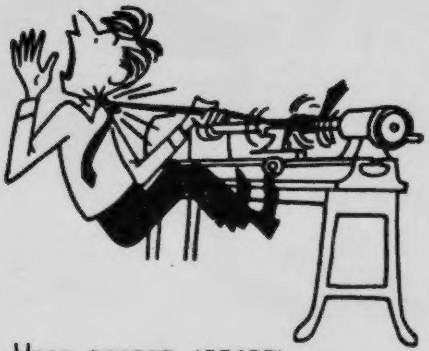
9. **SECURE WORK**--Use clamps or a vice to hold work pieces. **DANGER**--Loose work pieces can cause injury.



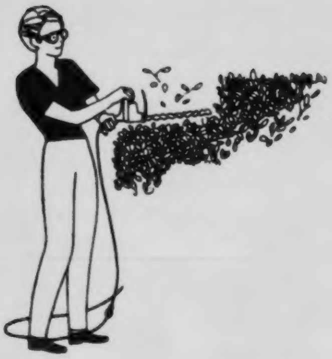
10. **DO NOT FORCE TOOL**--Tools do a better and safer job when used in the manner for which they are designed.

11. **STORE IDLE TOOLS**--When tools are not in use, store in a dry, locked place. Inspect tools for good working order prior to storage and before re-use.

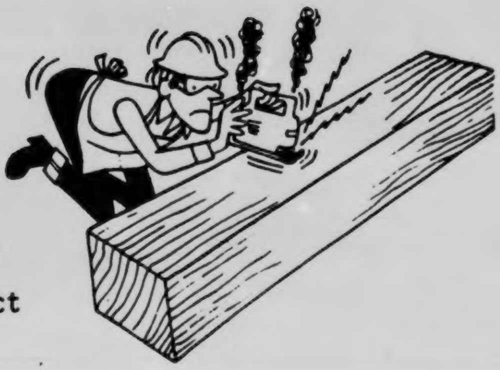




12. **WEAR PROPER APPAREL**—Loose clothing, dangling jewelry and long hair may get caught in moving parts.



13. **WHEN TOOL IS USED OUTDOORS**--Only use extension cord marked "For Outdoor Use." Extension cords when not in use should be stored in a dry and well ventilated area.

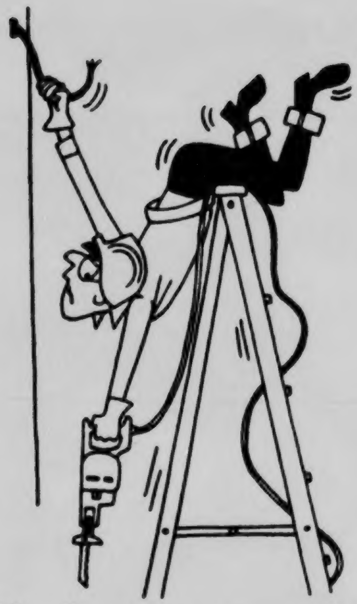


14. USE THE CORRECT TOOL--
Plan the work to be
done and use the correct
tool for the job.

15. USE SAFETY GLASSES with side
shields when working with
power tools. Use face or
dust mask in dusty work areas.
This applies to all persons
in the work area. Also,
safety gloves and shoes when
necessary.

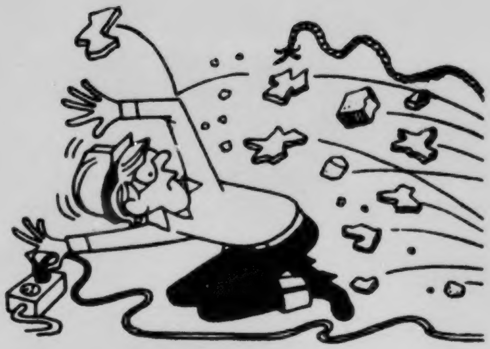
16. DISCONNECT TOOLS--When not in use, before
servicing or adjusting, before changing
accessories or when storing, disconnect
power supply cord.

17. SWITCHES--Never use a tool with a
malfunctioning switch. Have it
repaired or replaced before using
a tool.

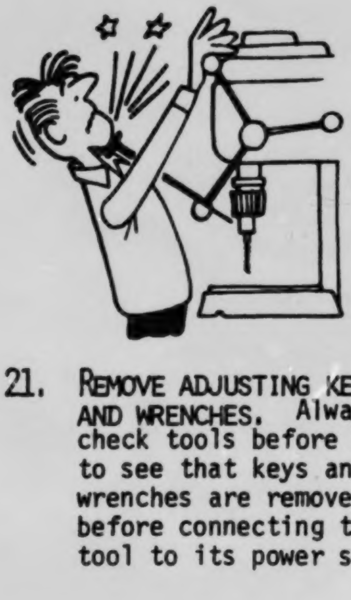


18. **DO NOT OVERREACH**--Keep proper footing and balance at all times.

19. **DO NOT ABUSE CORDS**--Never carry a tool by its power cord or yank cord or extension cords from the receptacle. **DANGER**--Keep power and extension cords from excessive heat and sharp edges.



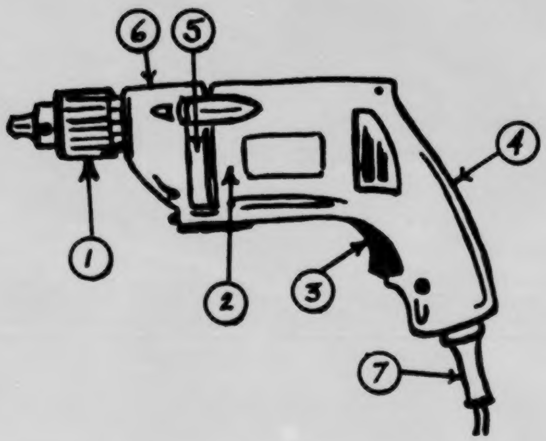
20. **AVOID ACCIDENTAL STARTING**--Do not carry plugged in tools with your finger on the switch. Be certain the switch is "OFF" when plugging tool into electrical power supply.



21. **REMOVE ADJUSTING KEYS AND WRENCHES.** Always check tools before use to see that keys and wrenches are removed before connecting the tool to its power supply.

22. **MAINTAIN YOUR TOOLS**--Follow the manufacturer's recommended maintenance procedures. Keep cutting edges clean and sharp for safe operation of the tool. Have necessary repairs made by proper service people.

ELECTRIC DRILL



1. Geared Key Chuck
2. Housing
3. Insulated Trigger Switch
4. Pistol Grip Handle
5. Motor Cooling Fan
6. Reduction Gear
7. Cord Strain Reliever

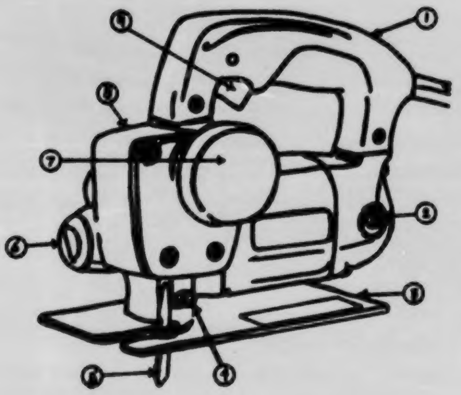
1. Operate only with the teacher's permission and after instruction has been received.
2. Remove jewelry, eliminate loose clothing, and confine long hair before using the drill.
3. Always use the proper eye protection.
4. Unplug the drill when changing bits.
5. Make sure the switch is off and the key removed before connecting the drill to a power source.
6. Mark the hole location with a center punch (metal) or awl (wood) before drilling.
7. Be sure the work is tightly clamped or secured before drilling.
8. Drill with straight, even, steady pressure.
9. Use sharp, straight bits of the size intended for the machine.
10. Never try to use a square-tang auger bit in a portable drill motor.
11. Lay the coasting drill down with the bit pointing away from the operator.
12. Do not drill through cloth with this tool.
13. Always use the screwdriver attachment in such a way that it cannot injure the operator if it slips off the work.
14. Select the drilling speed that is suitable for the work being done.

15. Relieve the pressure on the drill just before it breaks through a piece of metal to prevent "seizing."

16. Never lock the switch in the "on" position when the portable drill is held in the hands. The switch lock should be used only when the portable drill is fastened in a stand.

17. Have a firm grip on a portable electric drill when drilling holes in metal.

BAYONET SAW



1. Handle
2. Brushes
3. Base
4. Blade Screw
5. Blade
6. Lubricant Port
7. Guide Knob
8. Housing
9. On-Off Switch

1. Operate only with the teacher's permission and after instruction has been received.

2. Remove jewelry, eliminate loose clothing, and confine long hair before using the saw.

3. Make sure all the guards are in place and operating correctly.

4. Always use the proper eye protection.

5. Make sure the blade is the correct type for the material to be sawed, and that it is tightly clamped into the chuck.

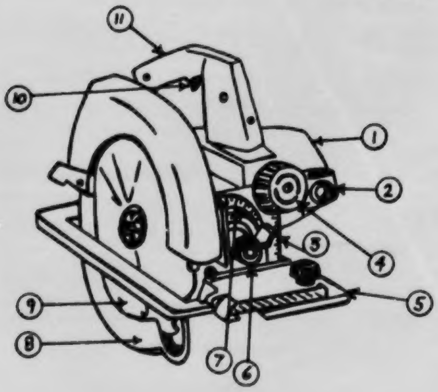
6. Be sure the switch is off before connecting the saw to the power source.

7. Use a vise or clamps to securely hold the materials to be cut.

8. Keep the cutting pressure constant. Do not force the blade into the work.

9. Always keep the hose tightly against the metal being cut.
10. Do not put the saw down on the bench until it has stopped.
11. Be sure to lay the tool on its side if the blade is in the tool.
12. Always disconnect the cord when repairing or adjusting the saw and when changing blades.
13. Avoid cutting curves so sharply that the blade will twist and break.

CIRCULAR SAW



1. Housing
2. Brush Holder
3. Depth Scale
4. Depth Lock Knob
5. Tilting Base
6. Tilt Lock Knob
7. Angle Scale
8. Retractable Guard
9. Saw Blade
10. Insulated Trigger Switch
11. Contoured Handle

1. Operate only with the teacher's permission and after instruction has been received.
2. Remove jewelry, eliminate loose clothing, and confine long hair before using the saw.
3. Make sure all the guards are in place and operating correctly.
4. Always use the proper eye protection.
5. Make sure that the retractable guard returns automatically to cover the blade after each cut.
6. Check the base setting for the proper depth of each cut.
7. Make sure that the power cord is clear of the blade.
8. Be sure the material to be cut is adequately supported.
9. Do not start the cut until the saw has reached its full speed.

10. Advance the saw slowly and straight through the work. Do not twist or turn the tool.

11. Stop cutting immediately if the blade binds or smokes.

12. Extend the blade below the work until the blade gullets clear the material.

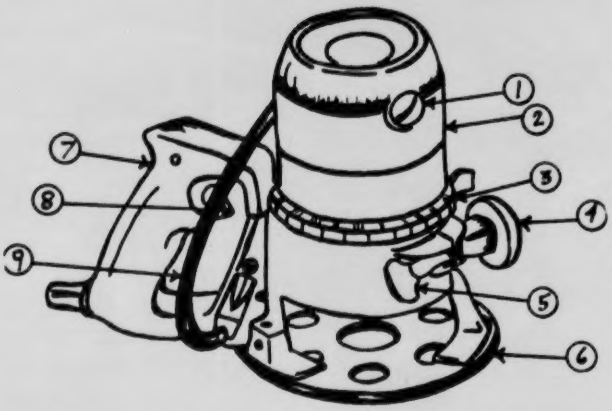
13. Do not lay the saw down until the blade stops.

14. Do not overreach. Keep the proper footing and balance at all times.

15. Support the stock in such a way that the kerf will not close and bend the blade either during a cut or at the end of a cut.

16. Unplug the machine to change blades or make adjustments.

ROUTER



1. Brushes
2. Housing
3. Micrometer Depth Adjustment
4. Guide Knob
5. Locking Handle
6. Sub-Base
7. D-Handle
8. Insulated Trigger Switch
9. Motor Safety Disconnect

1. Operate only with the teacher's permission and after instruction has been received.

2. Remove all jewelry, eliminate loose clothing, and confine long hair before using this tool.

3. Make sure all the guards are in place and operating correctly.

4. Always use the proper eye protection.

5. Be sure the switch is off before inserting the plug into the power source.

6. Be sure the collet chuck is tight, and the bit is secure.

7. Make sure the work piece is clamped or rigidly held, and the area of the router travel is free of obstructions.

8. Hold the router with both hands. The cutting pressure should be constant. Do not force or jam the router into the work.

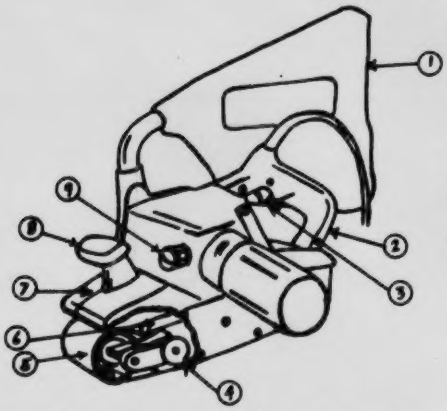
9. Make a trial cut on a piece of similar scrap material.

10. Disconnect the router from the power source when changing bits, making adjustments, or when it is not in use.

11. Feed the machine so that the leading edge of the knife is "biting in" as the router is pushed along.

12. Lay the machine down with the cutter pointing away. Beware of the coasting machine.

BELT SANDER



1. Dust Bag
2. D-Handle
3. Trigger Switch
4. Belt Tracking Adjustment
5. Belt
6. Belt Striker Bar
7. Housing
8. Front Handle
9. Brush Holder

1. Operate only with the teacher's permission and after instruction has been received.

2. Remove jewelry, eliminate loose clothing, and confine long hair before using the sander.

3. Always use the proper eye protection.

4. Check to see if the belt is in good condition, tracking properly, and is the correct grit size for the job.

5. Be sure the switch is off before connecting the sander to the power source.

6. Start the sander above the work. Let the rear of the belt touch first; then level the sander. Do not tilt it sideways.

7. Sand in the direction of the grain of the wood, moving back and forth over a large area. Do not pause in one spot.

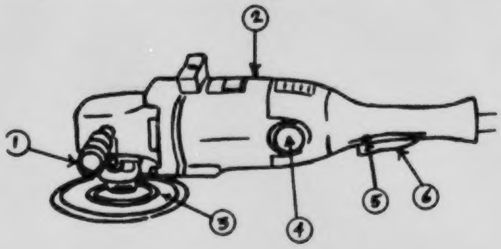
8. Keep the electrical cord and the dust bag away from the working area.

9. Lift the sander off the work and wait until it has stopped before placing it on the bench.

10. Make sure the opening of the dust bag is clean. In some types of sanding dust, there is a danger of spontaneous combustion if the dust is left in the bag.

11. Firmly fasten the work to be sanded. The sander exerts a tremendous pulling force.

DISC SANDER



1. Auxiliary Handle
2. Motor
3. Back-up Pad
4. Brush Cap
5. Switch Locking Button
6. Trigger Switch

1. Operate only with the teacher's permission and after instruction has been received.

2. Remove jewelry, eliminate loose clothing, and confine long hair before using the sander.

3. Make sure all the guards are in place and operating correctly.

4. Always use the proper eye protection.

5. Be sure the switch is in the "off" position before connecting the sander to the power source.

6. Make sure the back-up pad and disc are securely fastened to the tool. Unplug the sander when changing discs.

7. Stand clear of the spark line or spark area.

8. Sand or finish with a striking motion. Do not pause in one spot.

9. Do not allow the edge of the disc to touch the edge of the stock.

10. Place the sander on its back or on a rubber stand when it's not in use. Disconnect it from the power source when it's not in use for extended periods of time.

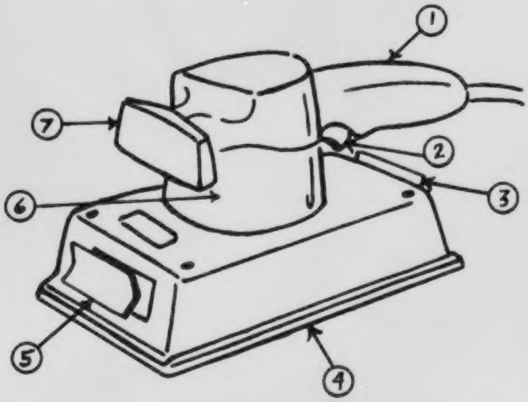
11. Hold the sander under a bench or provide other protection when starting up a new disc.

12. Sand only on the downstroke side of the disc.

13. Do not hold small pieces of work in the hand.

14. Wear a dust mask when sanding masonry.

FINISHING SANDER



1. Handle
2. Insulated Trigger Switch
3. Paper Clamp
4. Pad
5. Paper Clamp
6. Housing
7. Front Hand Knob

1. Operate only with the teacher's permission and afer instruction has been received.

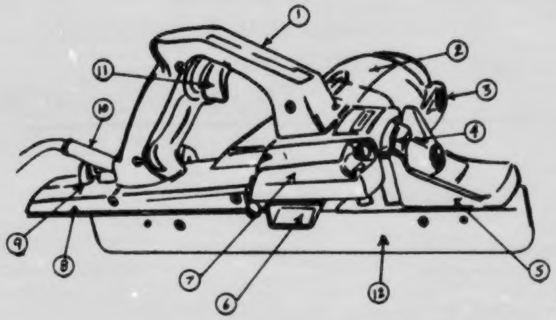
2. Remove jewelry, eliminate loose clothing, and confine long hair before using the sander.

3. Always use the proper eye protection.

4. Be sure the switch is in the "off" position before connecting the sander to the power source.

5. Make sure the abrasive sheet is in good condition and properly installed on the tool.
6. Start the tool above the work, set it down evenly, and move slowly over a wide pattern area.
7. Do not put the sander on the workbench until it has stopped running.
8. Never lift or carry a portable electrical tool by the power cord.
9. Do not overload the sander by pushing down. Allow the weight of the sander to supply the pressure.
10. Always keep the hands clear of the moving abrasive when operating the sander.

PLANER



1. D-Handle
2. Housing
3. Brush Holder
4. Depth Adjustment
5. Front Shoe
6. Chip Deflector
7. Guard
8. Rear Shoe
9. Cord Deflector
10. Cord Strain Reliever
11 Insulated Trigger Switch
12. Fence

1. Operate only with the teacher's permission and after instruction has been received.
2. Remove jewelry, eliminate loose clothing, and confine long hair before using the planer.
3. Make sure all the guards are in place and operating correctly.
4. Always use the proper eye protection.
5. Before connecting the planer to the power source, make sure the switch is in the "off" position.
6. Make all adjustments with the planer disconnected for the power source.

7. Place the front shoe on the work piece and start the motor. Then move the plane over the work, keeping a constant speed and pressure.

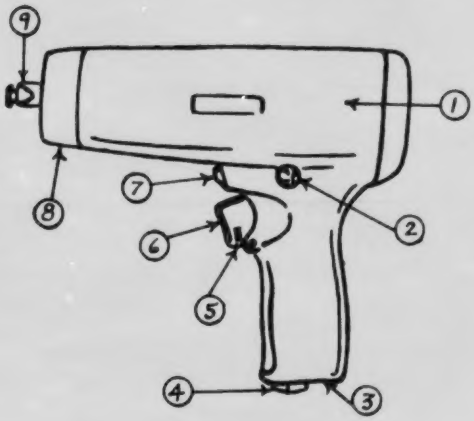
8. Keep the fence and rear shoe tightly against the work piece until the cutter has cleared the work.

9. Keep the hands on the handle and motor housing and away from the cutter head.

10. Be sure there is a clearance for the motor.

11. Do not lay the planer down until the cutter stops rotating.

AIR IMPACT WRENCH



1. Housing
2. Reversing Valve
3. Built-in Oiler
4. Compressed Air Inlet
5. Output Torque Control
6. Trigger Switch
7. Exhaust Air Outlet
8. Rubber Nose Guard
9. Square Drive

1. Operate only with the teacher's permission and after instruction has been received.

2. Remove jewelry, eliminate loose clothing, and confine long hair before using this tool.

3. Always use the proper eye protection.

4. Make sure all the hoses and fittings are tightened securely before opening the outlet air valve.

5. Be sure that the recommended air line pressure is used (approximately 90 to 100 P.S.I.).

6. Use only an impact socket.

7. For tightening or loosening fasteners, use the tool in short bursts to avoid the possibility of stripping a bolt.

8. To check the rotation, use the tool in short bursts.

9. When work is completed:

   (a) shut off the air supply to the tool hose,
   (b) vent the compressed air in the hose by squeezing the trigger, and
   (c) disconnect the air tool from the air hose.

10. Store the air tool in a dry location.

PNEUMATIC HAND EQUIPMENT

Proper Installation

AIR REGULATORS--Clean, dry, lubricated air at the proper pressure is the most important requirement for proper operation of air tools.

Many tools are designed to operate at 90 psi unless otherwise specified.

MOISTURE SEPARATORS--On installations where the piping system does not provide clean, dry air, the use of filters at hose connection points is recommended. A good filter, kept properly drained, will remove nearly all the entrained water whereas a poor one is practically useless. Most filters do not have adequate water storage capacity and, unless provided with an auxiliary storage receiver or automatic trap, soon cease to function.

STRAINERS--Many tools are provided with air strainers. To eliminate air restriction these strainers must be kept clean and free of obstructions. Strainers or filters should be used at each hose outlet, particularly where pipe lines are old or are used intermittently.

LUBRICATION--Many pneumatic tools, because of their weight and space limitations, do not contain built-in lubricators. With such tools, air line lubricators must always be used, and their use is recommended with all air tools.

MOISTURE ELIMINATION--The amount of moisture carried by compressed air varies with the temperature. As the temperature drops afer compression, water is precipitated. In order to eliminate as much water as possible, compressors should be equipped with intercoolers, aftercoolers, and full-size receivers. These should be kept drained and in good working condition.

COMPRESSOR INTAKE--The intake should be located to obtain the coolest, driest, and cleanest air available. Intakes should be of ample size and as direct as possible. Steam pipes, escaping steam, and dusty or wet locations (as near roofs, floors, ground, etc.) should be avoided. When practical, take air from out-of-doors on the north side of the building. The proper screening and protection must be provided. Intake filters of suitable size should be used.

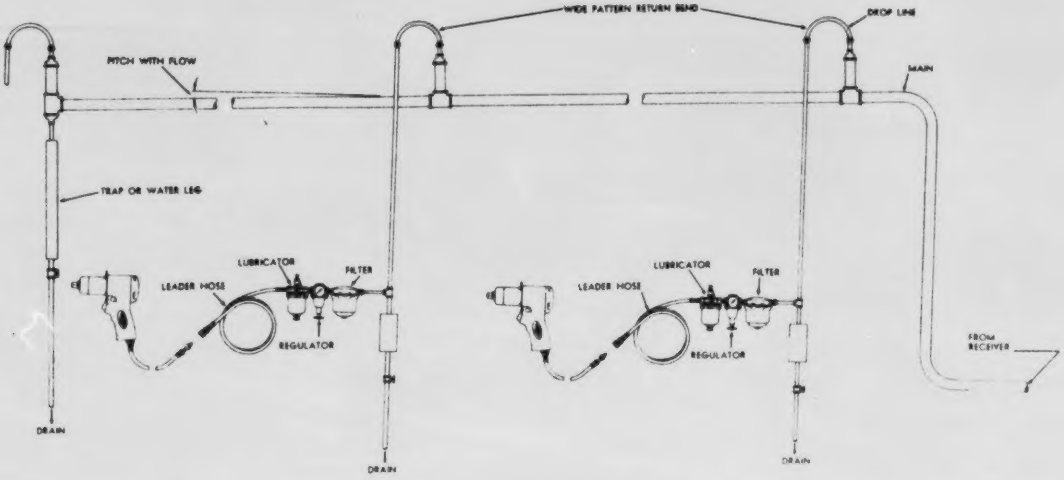
PIPING SYSTEM--Air mains and lines should be large enough to avoid excessive pressure loss under conditions of maximum flow.

In air lines, as in aftercoolers, water is continually precipitated as the air cools. For this reason, pipe lines should be provided with a means of draining or trapping this water before it reaches the hose outlets.

It is advisable to pitch the mains in the direction of the air flow, so that both gravity and air flow will carry the water to traps or water legs located at frequent intervals, These should be drained regularly and never allowed to become full and inoperative. The use of automatic traps will eliminate manual draining and the possibility of the traps becoming full. However, traps which drain to sewers can waste a considerable amount of air unless they are regularly inspected and kept in good working order. Provision for a quick and positive inspection of operation and for leakage should be made when the traps are installed. Three-way cock, or stop and waste cocks in the drains, are usually provided for this purpose.

To prevent condensed moisture from reaching the tools, down pipes, or hose connections should never be taken directly from the bottom of air pipes or mains. The connection should be made at the top of the main, and a long-radius return bend used.

Leaders, valves, and hose connections should be large enough to pass the maximum amount of air required by the tool or tools on the lines. This is particularly important if manifolds, from which several hose lines run, are used.


WIDE PATTERN RETURN BEND
DROP LINE
PITCH WITH FLOW
MAIN
TRAP OR WATER LEG
LUBRICATOR
FILTER
LEADER HOSE
REGULATOR
LUBRICATOR
FILTER
LEADER HOSE
REGULATOR
FROM RECEIVER
DRAIN
DRAIN
DRAIN

SAFETY RULES

1. All pneumatically driven nailers, staplers, and other equipment provided with an automatic fastener feed which operates at more than 100 pounds per square inch pressure at the tool head, shall have a safety device on the muzzle to prevent the tool from ejecting the fasteners unless the muzzle is in contact with the work surface. (OSHA)

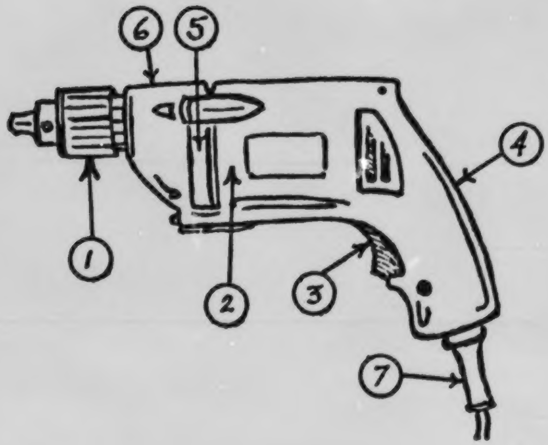
2. All pneumatic power tools shall have the operating trigger so located as to minimize the possibility of its accidental operation, and shall be arranged to close the air inlet valve automatically when the pressure of the operator's hand is removed.(OSHA)

3. The end of an air hose should not be dropped on the floor where it will pick up dirt, transport it into the tool, and cause the governor to stick.

4. Pneumatic tools are to be operated on clean, moisture-free air. The air is to be filtered and oiled with approximately three drops of air line oil per minute. Dirt and rust can cause the fovernor valve to stick in the open position and cause overspeeding.

60

ELECTRIC DRILL



1 Geared key chuck

2 Housing

3 Insulated trigger switch

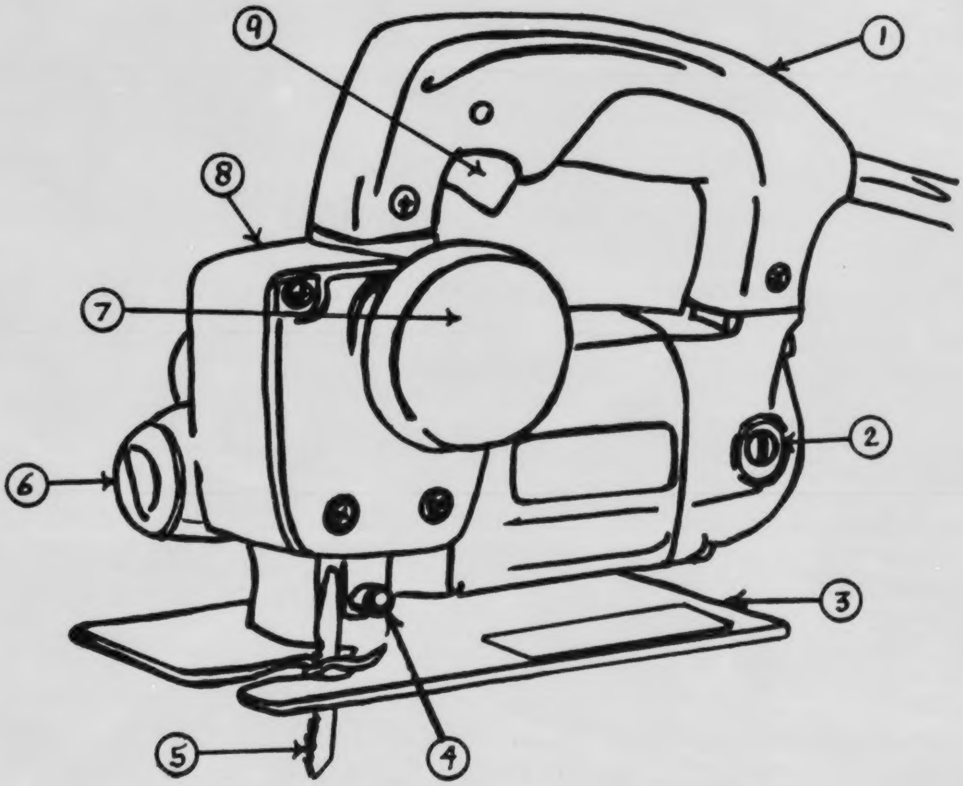
4 Pistol grip handle

5 Motor cooling fan

6 Reduction gears

7 Cord strain reliever

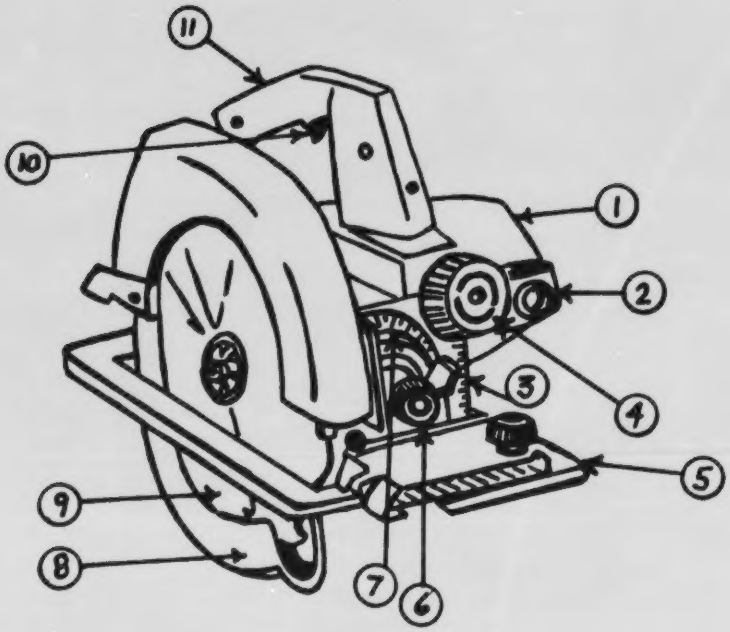
BAYONET SAW



1	HANDLE	6	LUBRICANT PORT
2	BRUSHES	7	GUIDE KNOB
3	BASE	8	HOUSING
4	BLADE SCREW	9	ON-OFF SWITCH
5	BLADE		

1377

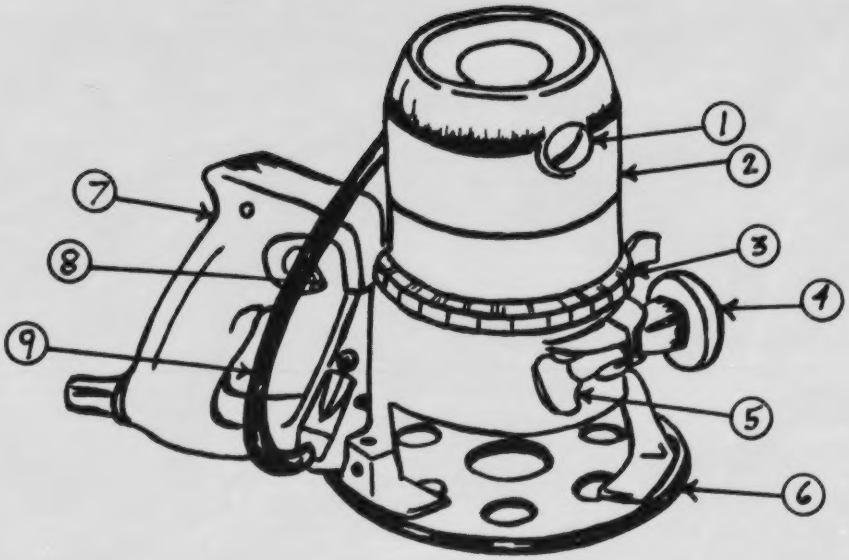
CIRCULAR SAW



1	Housing	6	Tilt lock knob
2	Brush holder	7	Angle scale
3	Depth scale	8	Retractable guard
4	Depth lock knob	9	Saw blade
5	Tilting base	10	Insulated trigger switch
		11	Contoured handle

1379

ROUTER



1 BRUSHES

2 HOUSING

3 MICROMETER DEPTH ADJUSTMENT

4 GUIDE KNOB

5 LOCKING HANDLE

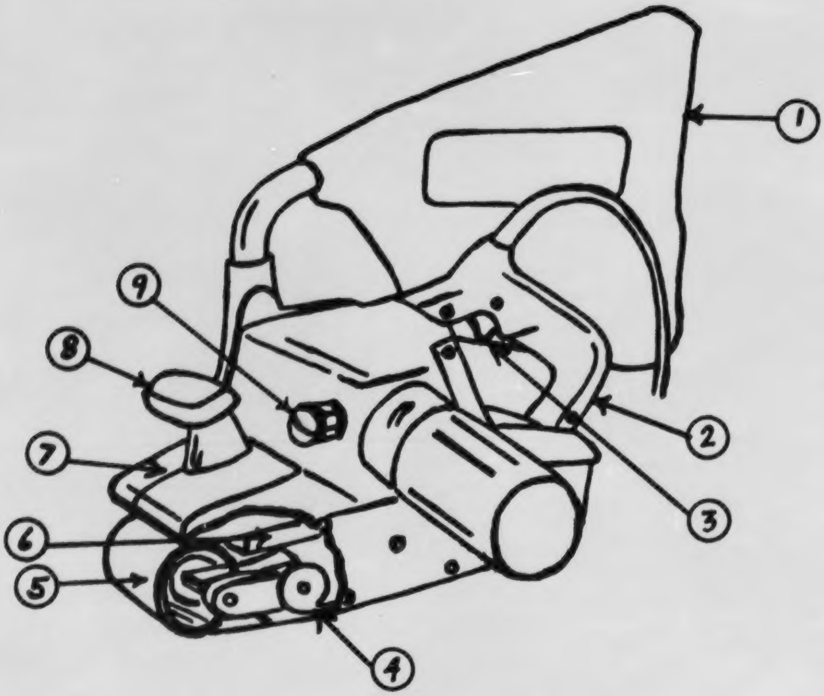
6 SUB-BASE

7 D-HANDLE

8 INSULATED TRIGGER SWITCH

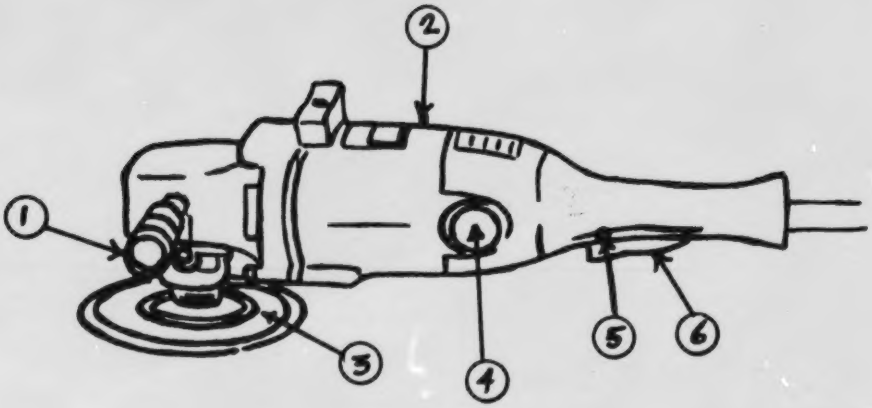
9 MOTOR SAFETY DISCONNECT

BELT SANDER



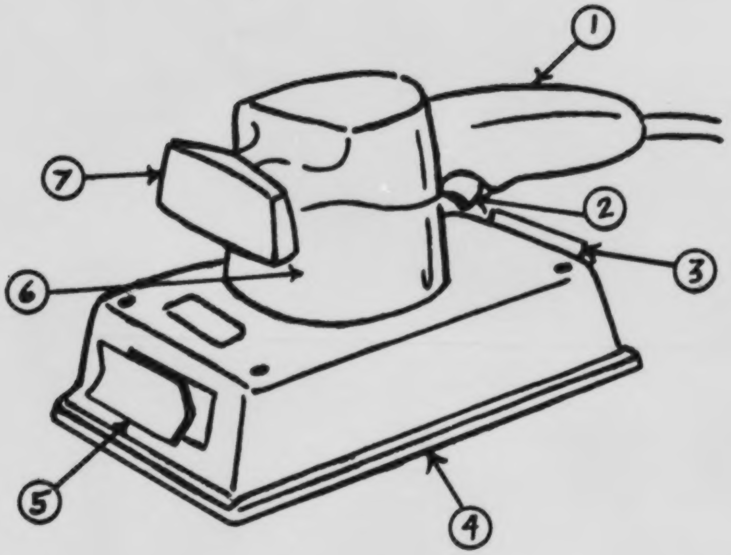
1 Dust bag
2 D-handle
3 Trigger switch
4 Belt tracking adjustment
5 Belt
6 Belt striker bar
7 Housing
8 Front handle
9 Brush holder

DISC SANDER



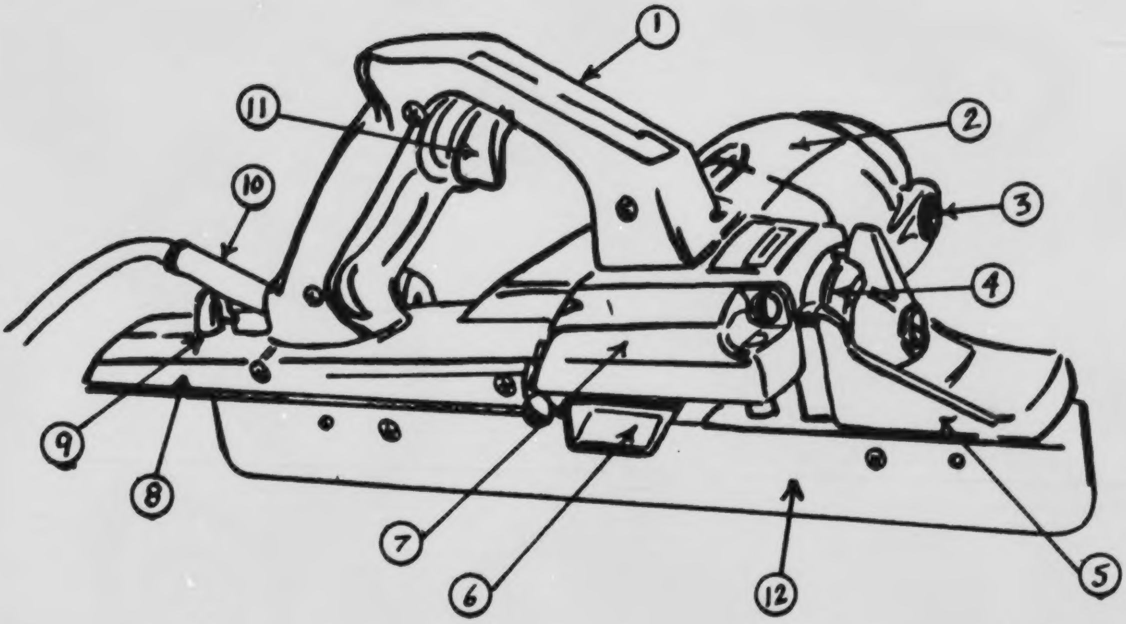
1 Auxiliary handle
2 Motor
3 Back-up pad
4 Brush cap
5 Switch locking button
6 Trigger switch

FINISHING SANDER



1 HANDLE
2 INSULATED TRIGGER SWITCH
3 PAPER CLAMP
4 PAD
5 PAPER CLAMP
6 HOUSING
7 FRONT HAND KNOB

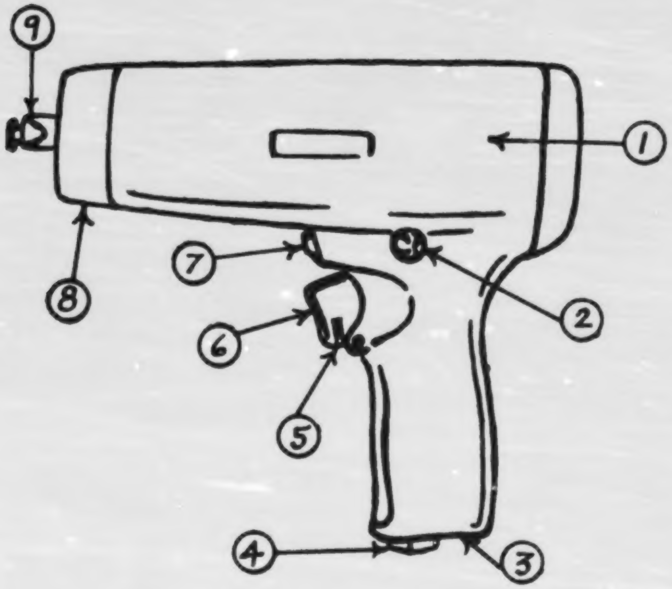
PLANER



1 D-handle
2 Housing
3 Brush holder
4 Depth adjustment
5 Front shoe

6 Chip deflector
7 Guard
8 Rear shoe
9 Cord deflector
10 Cord strain reliever
11 Insulated trigger switch
12 Fence

AIR IMPACT WRENCH



1 Housing
2 Reversing valve
3 Built-in oiler
4 Compressed air inlet
5 Output torque control
6 Trigger switch
7 Exhaust air outlet
8 Rubber nose guard
9 Square drive

REFERENCES

Materials were selected and review from the following sources, and in some instances were incorporated in the production of the preceding unit.

1. Sioux Tools, Inc.

2. Rockwell International Corporation

3. Pennsylvania Industrial Arts Safety Guide
   Pennsylvania Department of Education

4. Frank Paxton Lumber Co.

5. Occupational Safety Manual,
   Wyoming State Department of Education

6. NIOSA

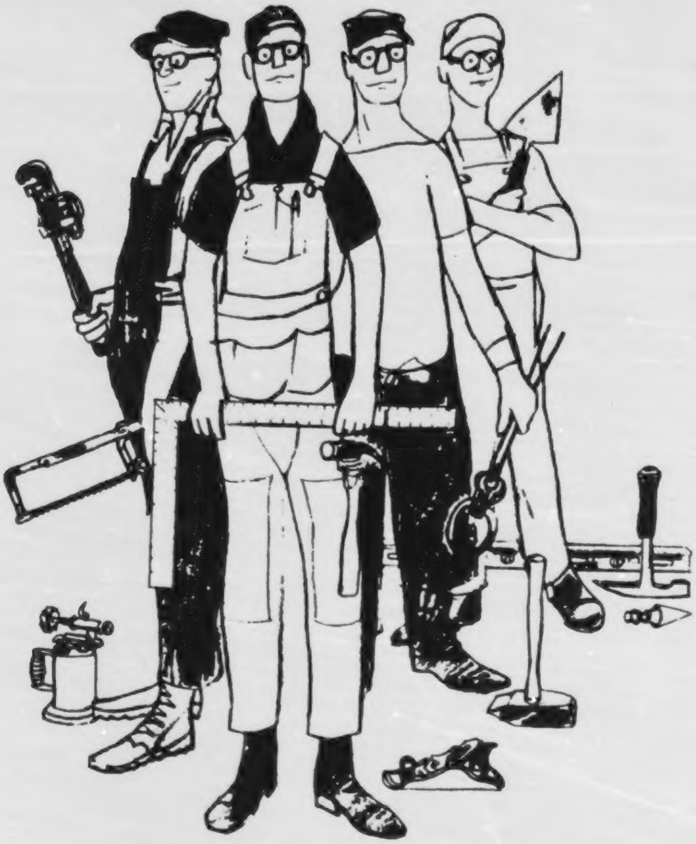
7. OSHA

8. Power Tools Institute, Inc.

HAND TOOLS FOR ELEMENTARY SCHOOL USE

Just about every child in the world loves tools.

1397



WARNING--No matter how tools are designed, THERE IS DANGER OF INJURY if the worker does not care for them properly, store them carefully, and use them as they were designed to be used. Overconfidence, or carelessness, can result in an injury that can keep a worker off the job for a long time.

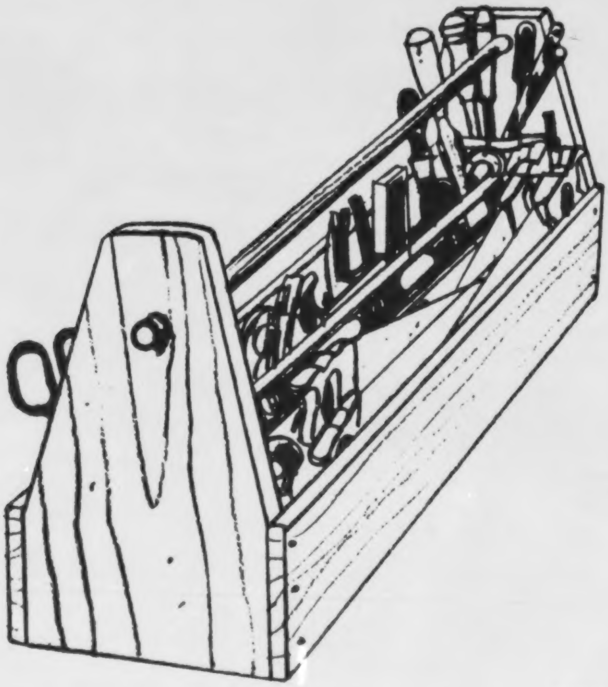
There are many kinds of tools...tools for carpenters...tools for bricklayers...tools for blacksmiths...tools for plumbers...and even tools for making tools.

Fun with tools can become a real pain, if those tools are not used properly. And the noise that will be heard is a loud scream!

To insure a happy time when using tools, always use the right tool for the job. Keep tools sharp, clean, and in good repair. Most important--learn how to use each one SAFELY.

They like to look at them... and to play with them... but mostly, they like to **make** things with them (including noise)

1399



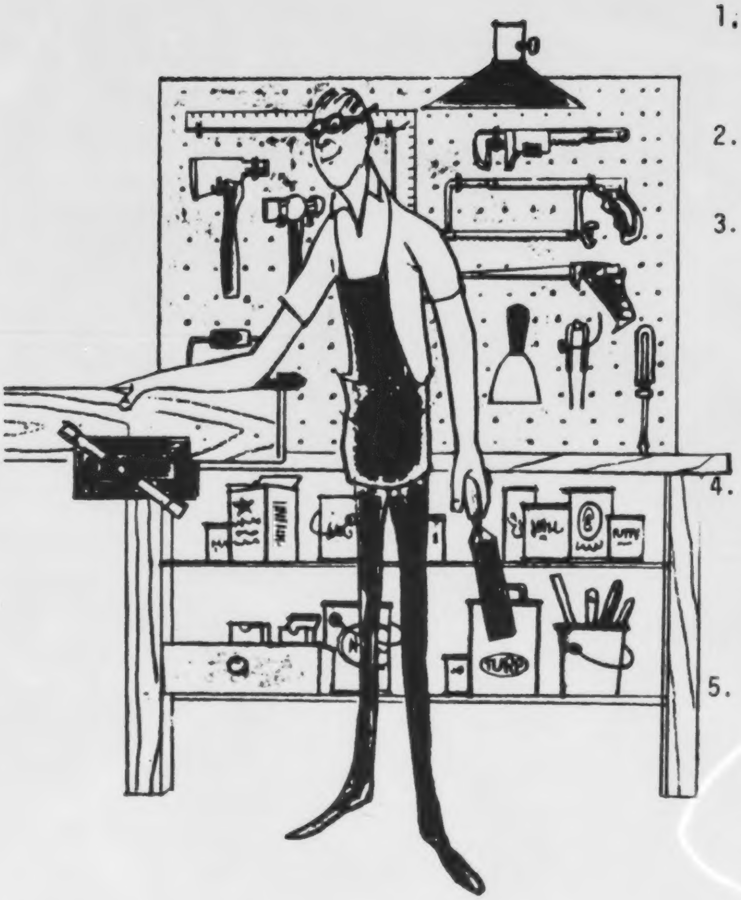
NEVER

PLACE SHARP TOOLS
WITH THE CUTTING
EDGES UP.

THIS CAN INCREASE THE DANGER

OF CUT FINGERS

And this is what his **TOOL BOX** looks like. Everything is kept sharp and in its right place so he can find things when he wants them. Can you always find your parents' tools... or do you leave them in the grass? Let's look at every tool in the box so you'll be ready when you get your own set.

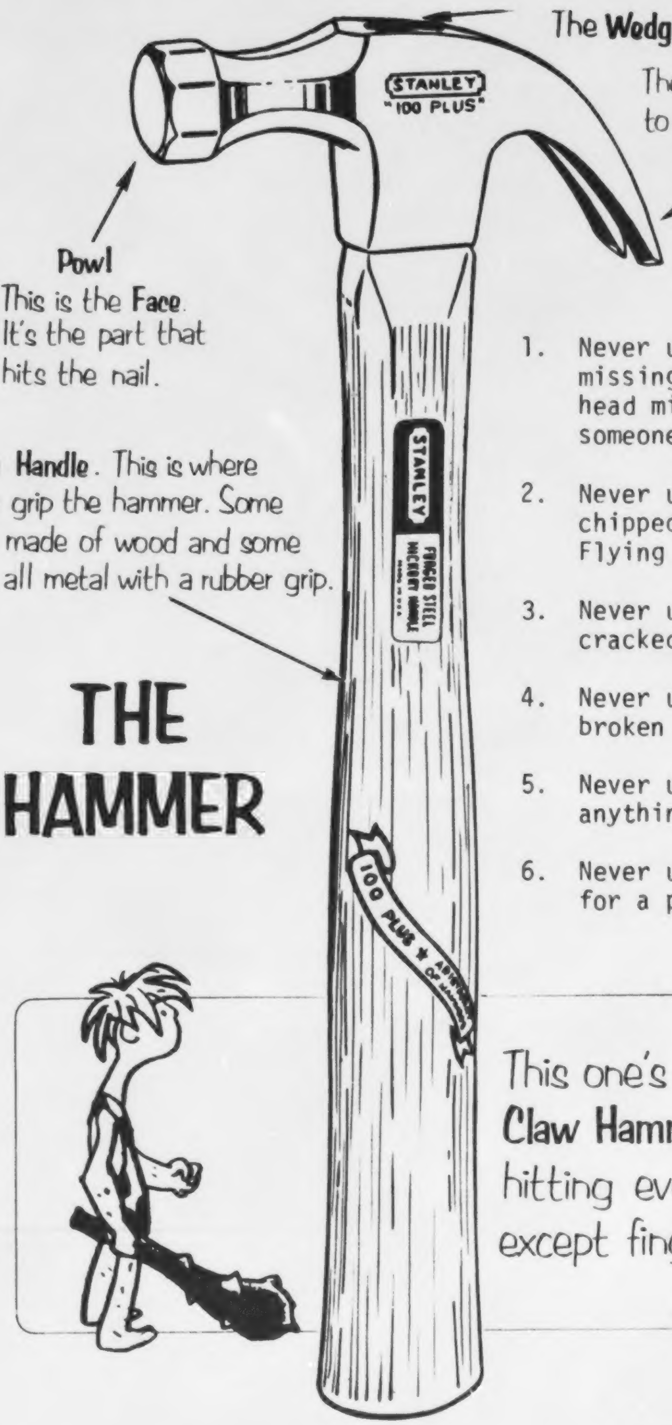


1. See how neatly all of the tools are placed.
2. The supplies are placed neatly, too.
3. If tools and supplies are kept in good condition and place where they belong, a worker won't have to spend a lot of time looking for what he/she want to use.
4. If tools are cleaned and in good condition before they are hung up, they will be ready for use when needed.
5. The neat storage of tools not only keeps them in good order, but helps keep them clean and in good condition. Therefore, clean, sharp, and functional tools are much safer to use and can also bring the user more enjoyment.

But the tools we know best are the ones that belong to our mom and dad. The ones they have in the cellar, or in the garage are mostly **Carpenter's Tools**. Mom uses tools too.

1401

THE HAMMER



The **Wedges** hold the head on.

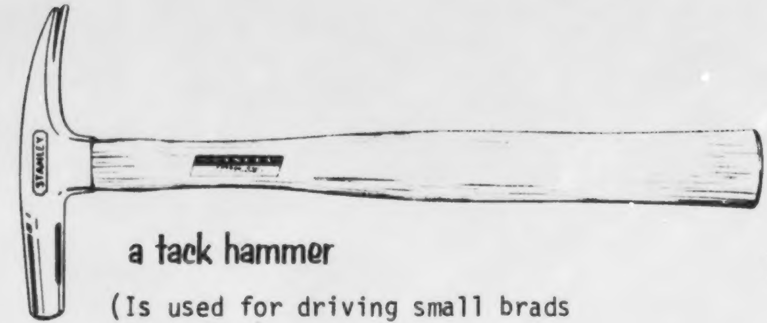
The **Claw**. This is what you use to pull out nails.

Pow!
This is the **Face**.
It's the part that hits the nail.

The **Handle**. This is where you grip the hammer. Some are made of wood and some are all metal with a rubber grip.

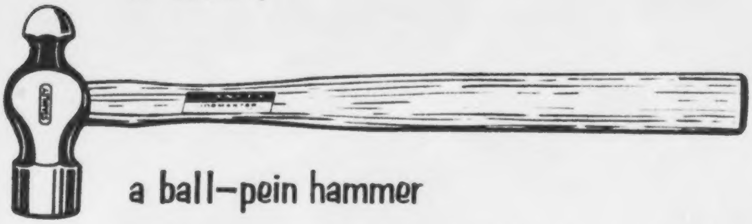
1. Never use a hammer with a missing wedge, because the head might come off and hit someone.
2. Never use a hammer with a chipped or mushroomed face. Flying chips will cut.
3. Never use a hammer with a cracked handle.
4. Never use a hammer with a broken claw.
5. Never use a claw hammer for anything but driving nails.
6. Never use a hammer handle for a pry bar.

This one's easy-- it's the **Claw Hammer** and it's for hitting every kind of nail except finger nails.



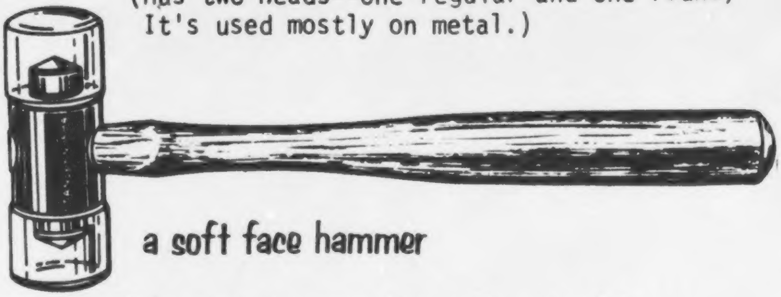
a tack hammer

(Is used for driving small brads or tacks.)



a ball-pein hammer

(Has two heads--one regular and one round) It's used mostly on metal.)

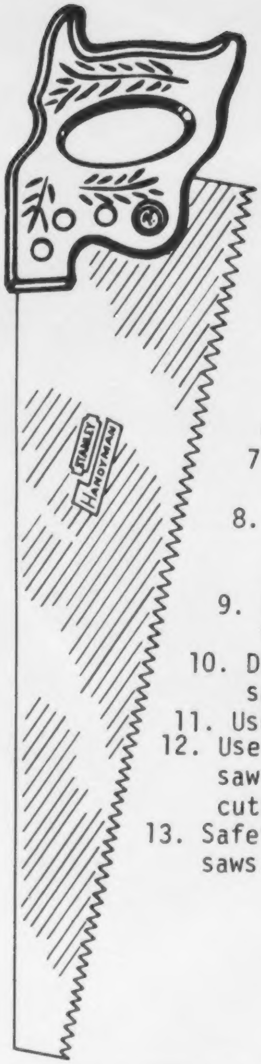


a soft face hammer

(Is used for pounding soft material, such as wood, when it's important not to make pound marks on the material. Heads or faces should be plastic, leather, lead, copper, or wood.)

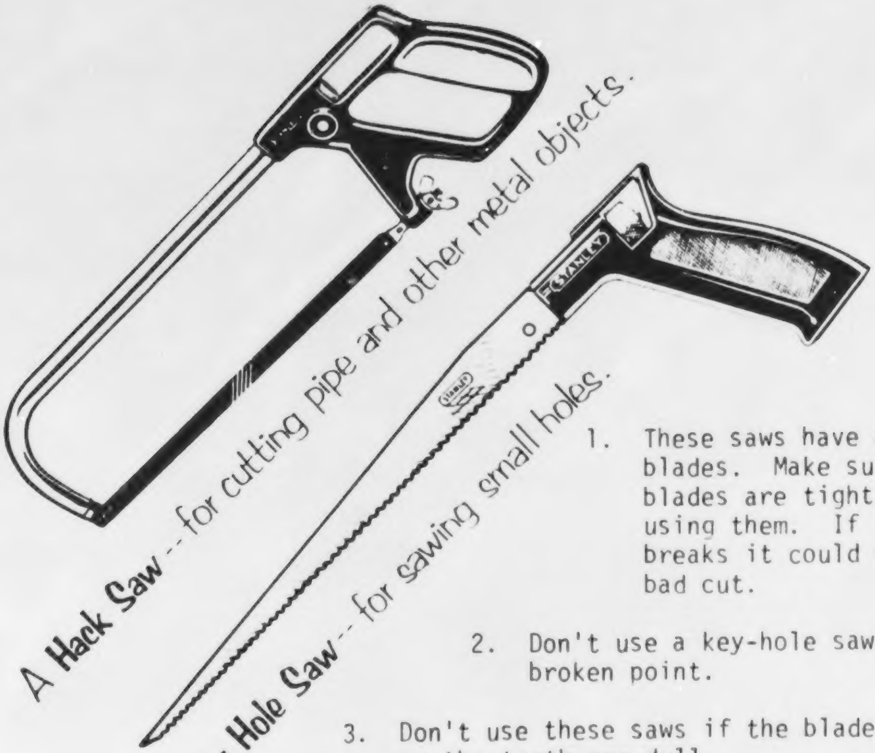
1. If any of these hammers were used on the wrong materials, they would either mar the material or damage the hammer.
2. Misuse of the hammer could result in smashed fingers.
3. Safety goggles or glasses are required when hammering.

Here are several other kinds of **hammers**. Which kind do you have in your house ...or in your Grandparents'?



1. Use the proper saw for each sawing job. Crosscut saws have small sharp teeth for cutting across wood grain. Rip saws have large flat teeth for cutting along wood grain.
2. Don't use a saw on a board that has nails in it.
3. Don't try to catch a falling saw. The sharp teeth may cut the hands.
4. Place the saw flat on the work table when it's not in use.
5. When starting a cut, keep the fingers out from under the blade. Use a piece of scrap wood as a guide to start the cut.
6. Don't walk around carrying a saw.
7. Don't place the saw under arm when changing the position of the wood.
8. After each use, put the saw in a safe storage place. This protects both the teeth and people.
9. Don't use a saw that has missing teeth, or one that is dull.
10. Don't put excessive pressure on the saw when sawing with it.
11. Use a wooden bench or sawhorse for sawing.
12. Use clamps or vises to hold the material when sawing. If the material slips, the danger of cutting the fingers is very high.
13. Safety goggles or glasses are required when using saws.

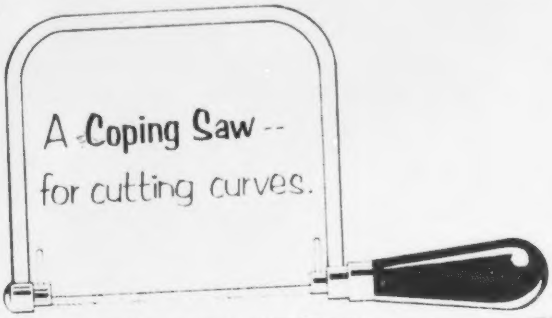
This is a **SAW**.
And it's got more teeth than a crocodile!
And they're just as sharp, so be careful!



A **Hack Saw**--for cutting pipe and other metal objects.

A **Key Hole Saw**--for sawing small holes.

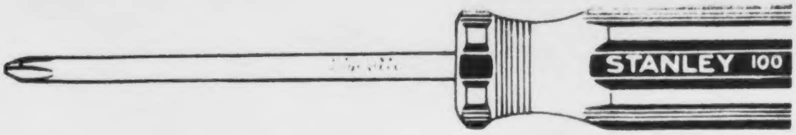
1. These saws have adjustable blades. Make sure the blades are tight before using them. If the blade breaks it could cause a bad cut.
2. Don't use a key-hole saw with a broken point.
3. Don't use these saws if the blades are bent or the teeth are dull.
4. Use a vise or clamping device when working with these saws. The tighter the material is held, the less danger there is of cutting oneself.
5. Safety goggles or glasses are required when saws are being used.



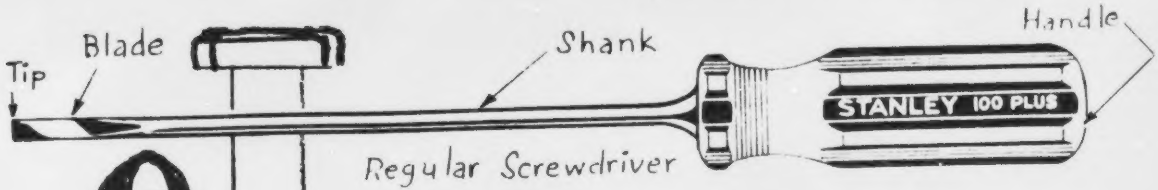
A **Coping Saw**--

for cutting curves.

Here are other kinds of **saws** for other uses. How many have you ever used?

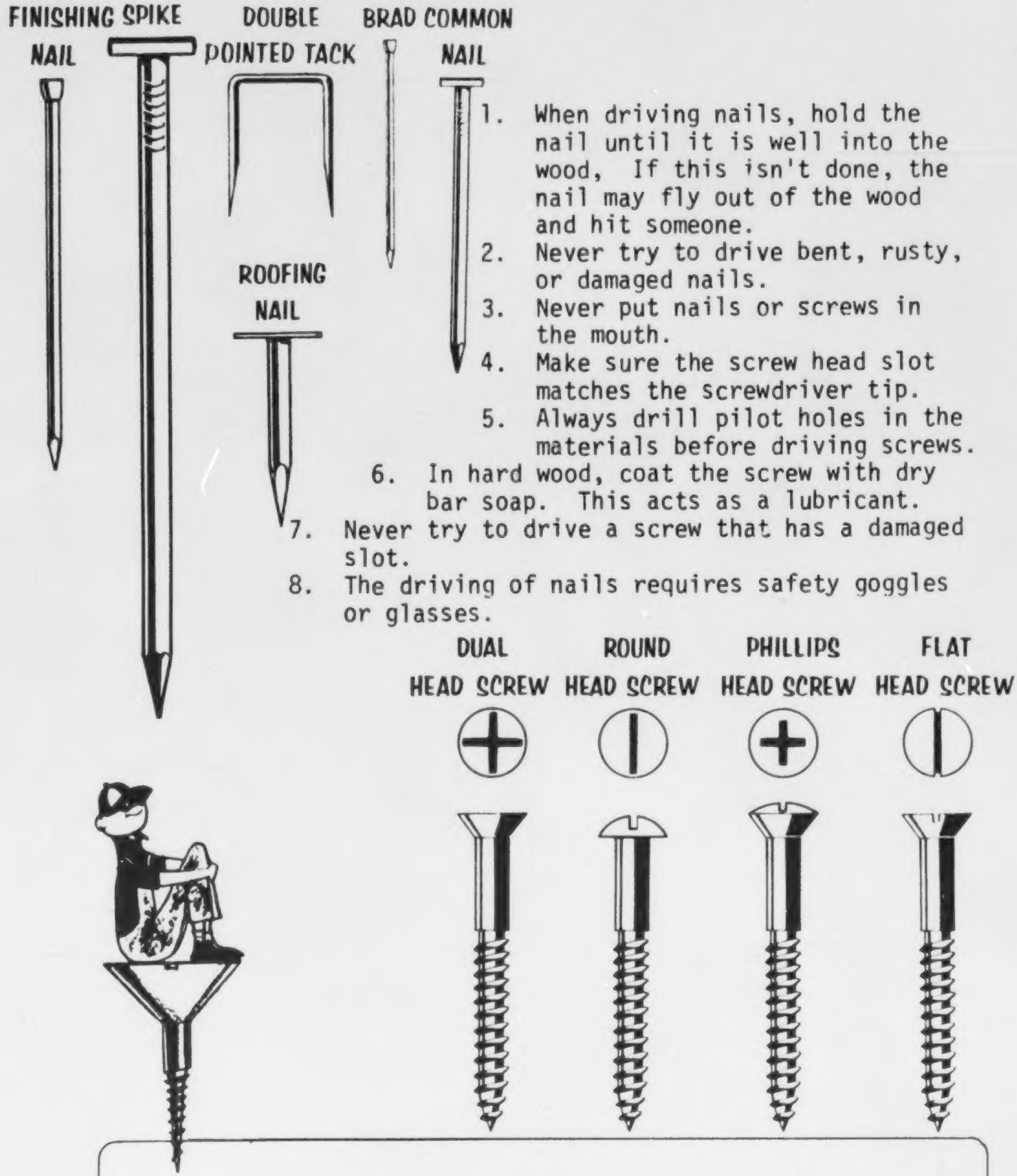


This is a **Phillips Screwdriver**. It looks different. Your Dad may use this one to tighten screws in his car or on your Mother's washing machine.



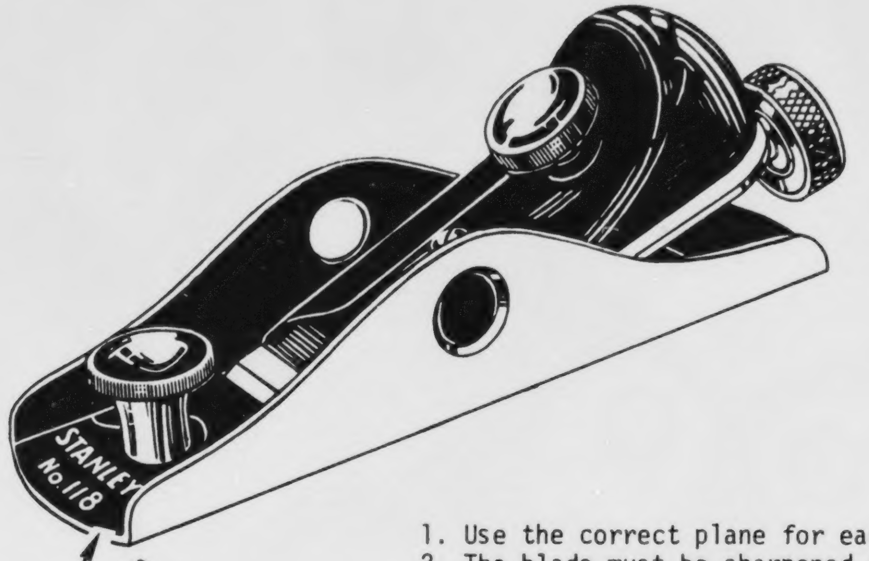
1. Don't use regular screwdrivers with uneven, chipped, cracked, or twisted blade tips.
2. Don't use screwdrivers for pry bars.
3. Don't use screwdrivers for nail pullers.
4. Don't carry a screwdriver in your pocket.
5. Don't use screwdrivers as a punch or chisel.
6. Don't use screwdrivers that have a loose or cracked handle.
7. Don't pound on the screwdriver handle with a hammer.
8. Don't use a wrench or pliers to turn the screwdriver.
9. Never work on an electrical appliance with a screwdriver, unless you know for certain the power is off.
10. Don't use a Phillips screwdriver with a damaged tip.
11. Use the proper size screwdriver tip for each size screw slot. If the screwdriver slips, it may puncture your hand.

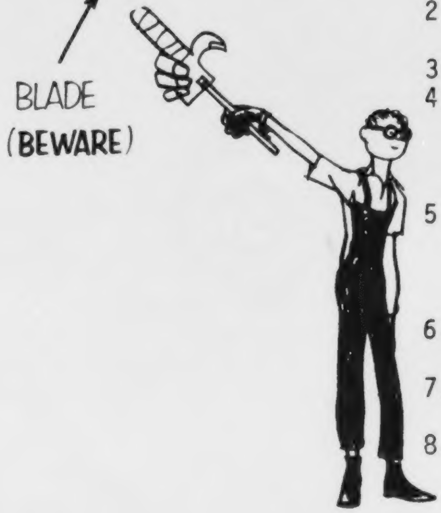
And here is the **SCREWDRIVER**.
It comes in all sizes and people
can never find any of them.
Do you ever forget
to put them back..?


FINISHING NAIL
SPIKE
DOUBLE POINTED TACK
BRAD
COMMON NAIL
ROOFING NAIL
DUAL HEAD SCREW
ROUND HEAD SCREW
PHILLIPS HEAD SCREW
FLAT HEAD SCREW

1. When driving nails, hold the nail until it is well into the wood, If this isn't done, the nail may fly out of the wood and hit someone.
2. Never try to drive bent, rusty, or damaged nails.
3. Never put nails or screws in the mouth.
4. Make sure the screw head slot matches the screwdriver tip.
5. Always drill pilot holes in the materials before driving screws.
6. In hard wood, coat the screw with dry bar soap. This acts as a lubricant.
7. Never try to drive a screw that has a damaged slot.
8. The driving of nails requires safety goggles or glasses.

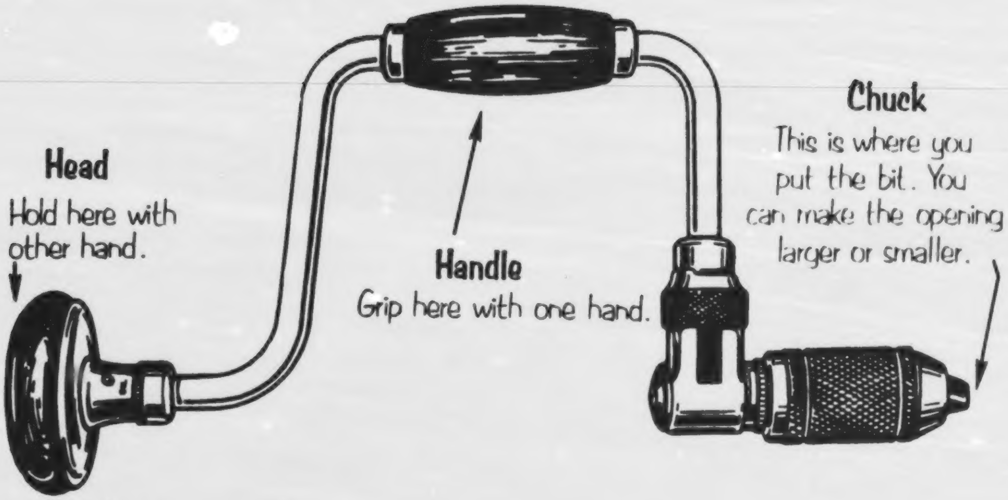
These are different kinds of nails and screws. There's a right size and a right kind for every job. This is very important.

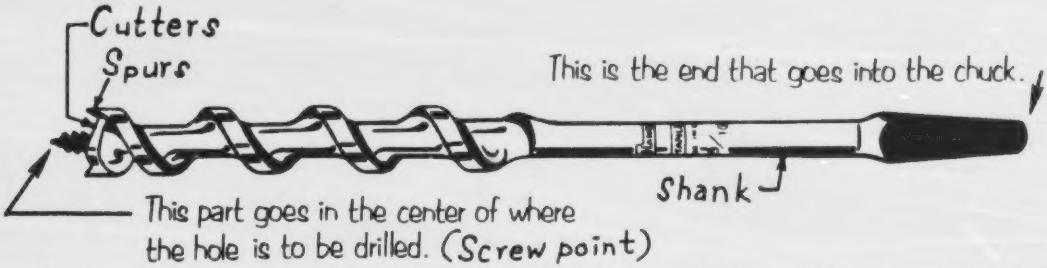




1. Use the correct plane for each operation.
2. The blade must be sharpened if it is chipped or dull.
3. Adjust the blade properly.
4. When not in use, lay the plane on its side. This prevents a change in the blade setting and also prevents damage to the cutting surface.
5. Never run hand or fingers across the blade to check the adjustment or the depth setting. That blade will also cut the skin.
6. Never use the bed of the plane as a pounding device.
7. Maintain the proper stance when using the plane.
8. Always use a vise or clamping device to hold the material that is being planed.

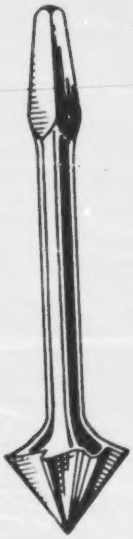
This is a **PLANE**. It smooths down wood and makes it come out in big curls that smell good. But be careful--it has a very sharp blade that sticks out the bottom.


Head
Hold here with other hand.
Handle
Grip here with one hand.
Chuck
This is where you put the bit. You can make the opening larger or smaller.

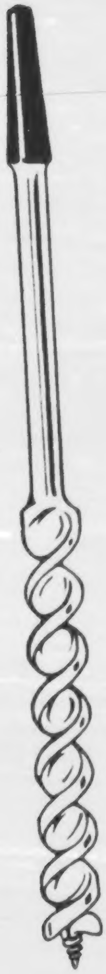

Cutters
Spurs
This is the end that goes into the chuck.
Shank
This part goes in the center of where the hole is to be drilled. (Screw point)

1. Never use a bit that has a damaged spur, cutter surface or screwpoint.
2. Use a scrap piece of wood behind the material in which a hole is being drilled. This prevents the bit from jumping through the material, which could cause one to lose a good grip on the brace. It could also damage the material.
3. All drilling must be done in a vise or a clamping device.
4. Drilling is much easier when done in a horizontal position.
5. Do not attempt to drill with any drill bit that has a bent shank.
6. Drilling requires safety goggles or glasses.

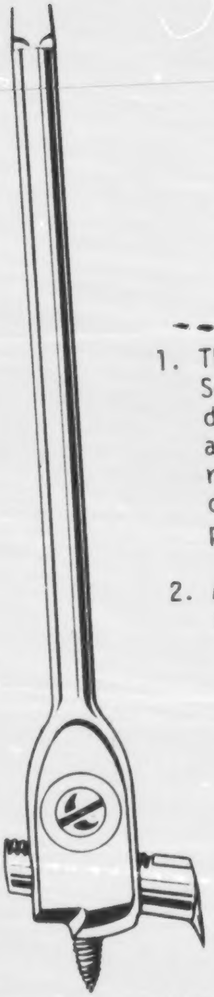
This is a **BIT BRACE** and it's used for drilling holes.



COUNTERSINK



AUGER BIT

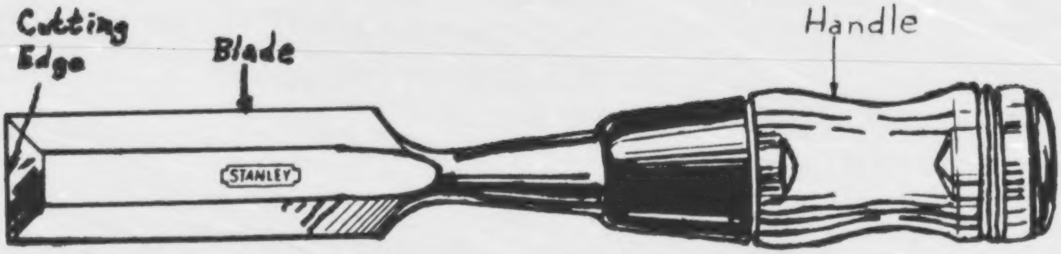


EXPANSIVE BIT

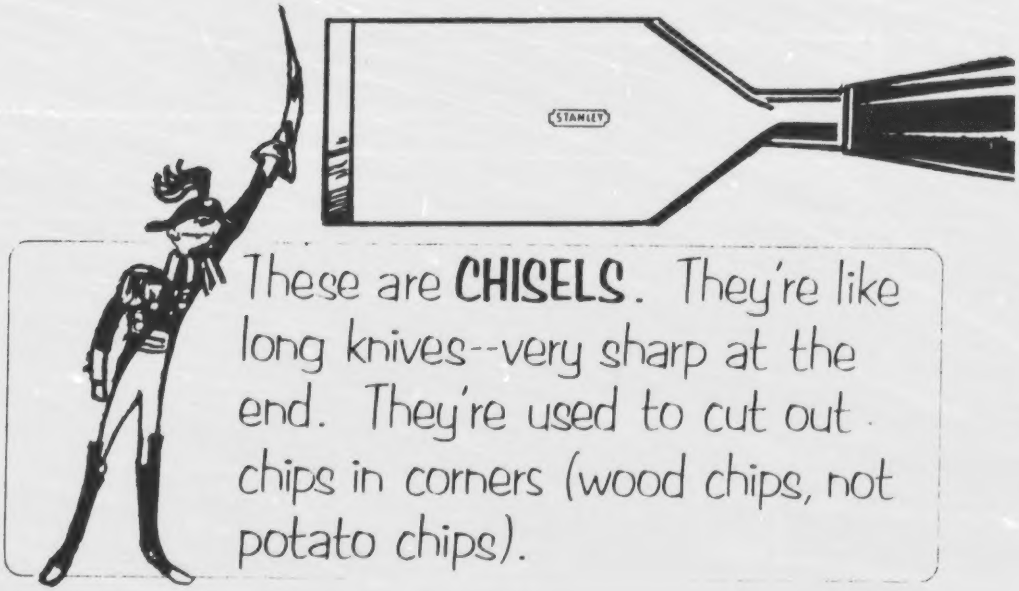
1. There are other types of drills. Some of them may be used to drill wood, plastic, leather, and metal. The same safety rules and operational procedures outlined on the previous page will apply.

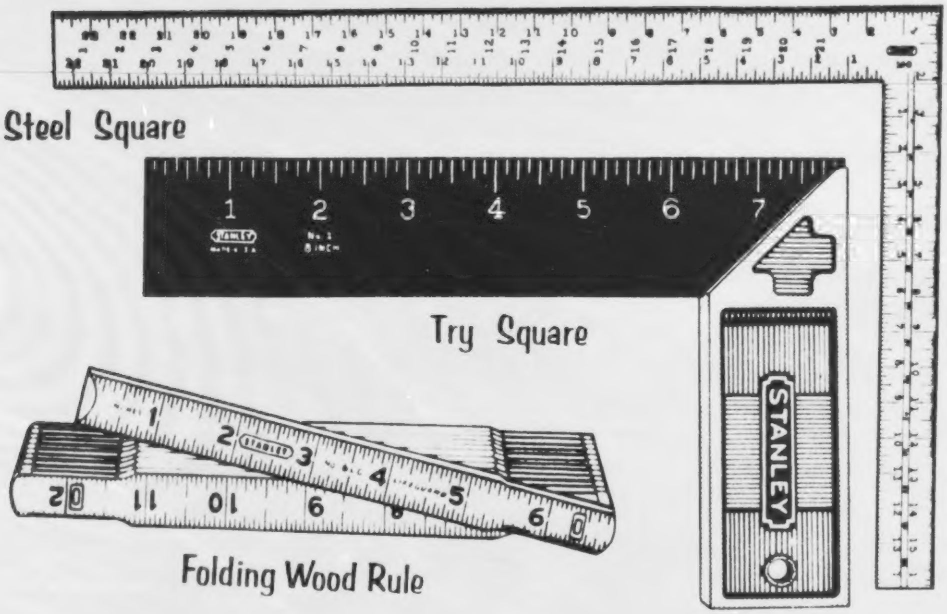
2. Any type of drilling requires safety goggles or glasses.

These are **BITS** that are used in the Bit Brace for drilling holes. Don't get dizzy watching them go round and round.


Cutting Edge
Blade
Handle
STANLEY

1. Never use a chisel that has a damaged blade or cutting surface.
2. Never use a chisel with a loose handle.
3. Some chisels are not made to hit with a hammer. There are special chisels that may be hit with a hammer, but one should be sure to use the correct chisel.
4. When using a chisel, always make sure the material is held in a vise or a clamping device. Loose material that is being chiseled could result in cut fingers or hands.
5. Always chisel away from the body and keep both hands behind the cutting edge.
6. Never run the fingers across the cutting surface to check its sharpness.
7. If a chisel is dropped, one should never try to catch it.
8. Never walk around with a chisel in a pocket. That is dangerous!
9. Store a chisel so the cutting edge is protected. Then it will not be a danger to the worker.
10. The safety rules for chisels MUST be used for any type of CARVING TOOL.


STANLEY
These are **CHISELS**. They're like long knives--very sharp at the end. They're used to cut out chips in corners (wood chips, not potato chips).

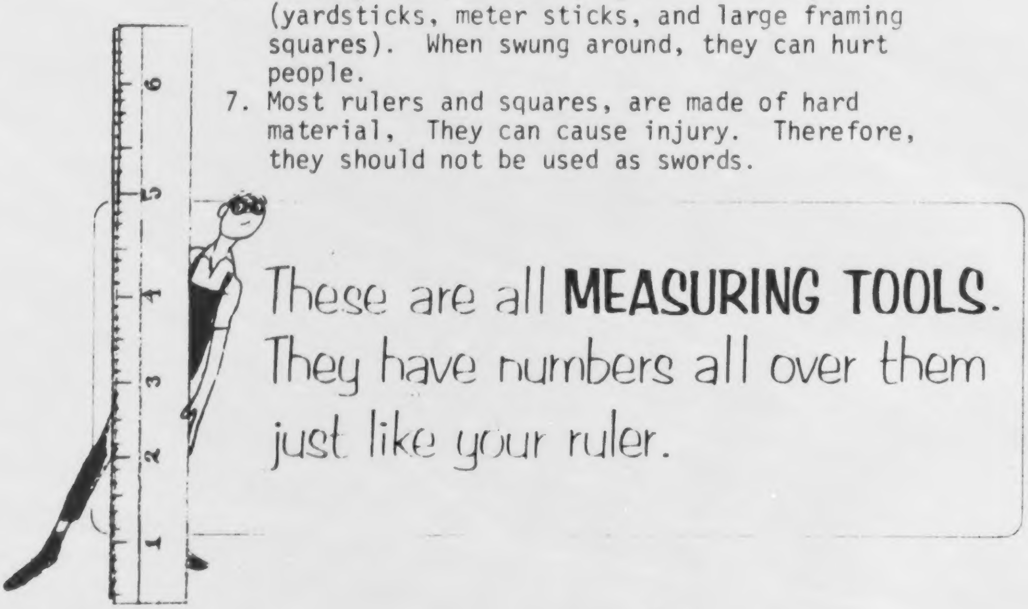

STANLEY
STANLEY
STANLEY

Steel Square

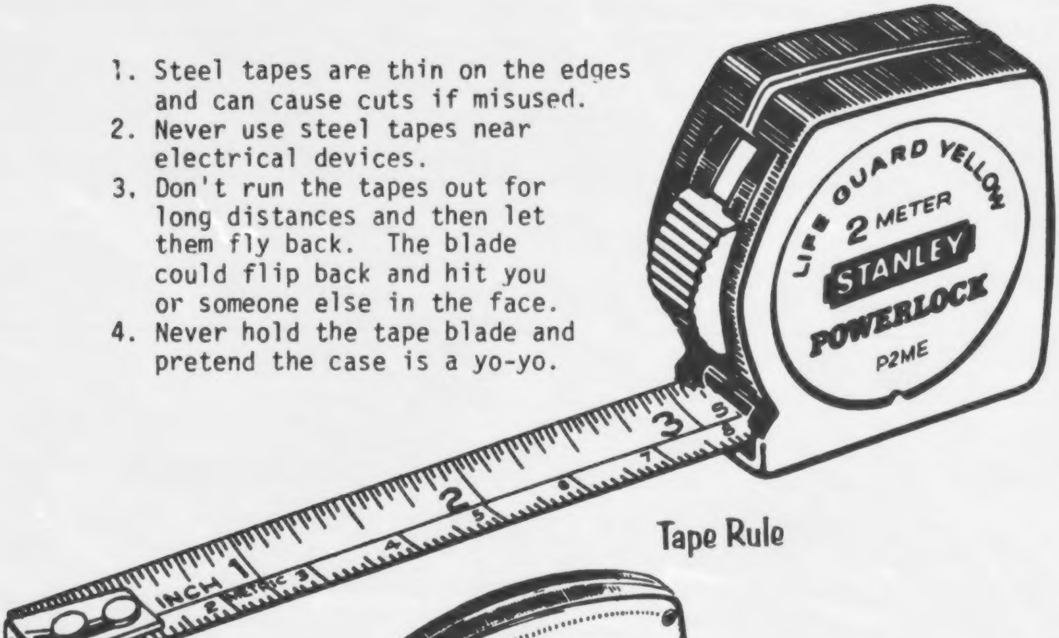
Try Square

Folding Wood Rule

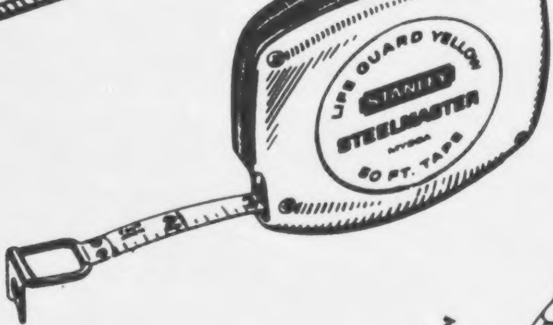
1. Don't use a ruler or square as a pry bar or scraper.
2. Don't use a ruler or square as a hammer.
3. Don't carry a ruler or square in your pocket. The only ruler that would be safe to carry in your pocket is a fold-up ruler, but only if it is folded up.
4. Never use the end of a ruler or square as a screwdriver.
5. Never use metal rulers or squares in or around electical equipment
6. Be very careful with long rulers or squares (yardsticks, meter sticks, and large framing squares). When swung around, they can hurt people.
7. Most rulers and squares, are made of hard material, They can cause injury. Therefore, they should not be used as swords.


These are all **MEASURING TOOLS**.
They have numbers all over them just like your ruler.

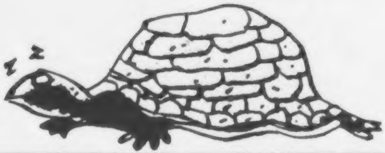
1. Steel tapes are thin on the edges and can cause cuts if misused.
2. Never use steel tapes near electrical devices.
3. Don't run the tapes out for long distances and then let them fly back. The blade could flip back and hit you or someone else in the face.
4. Never hold the tape blade and pretend the case is a yo-yo.


LIFE GUARD YELLOW
2 METER
STANLEY
POWERLOCK
P2ME
INCH
METRIC
1
2
3

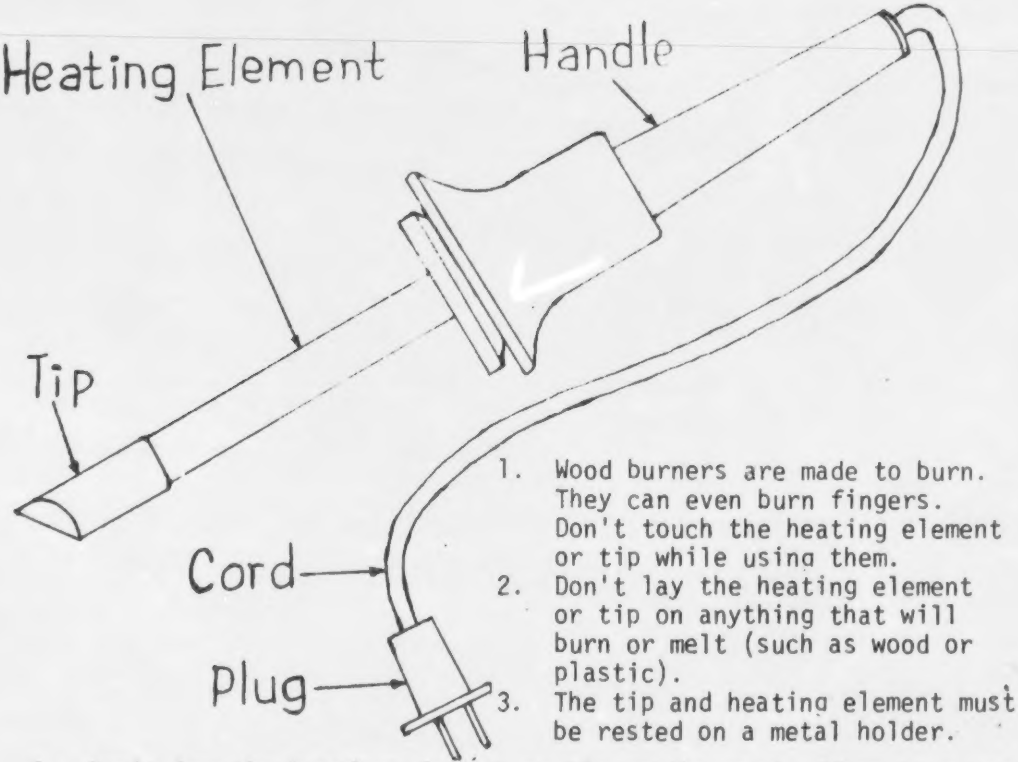
Tape Rule


LIFE GUARD YELLOW
STANLEY
STEELMASTER
50 FT. TAPE

Long Steel Tape

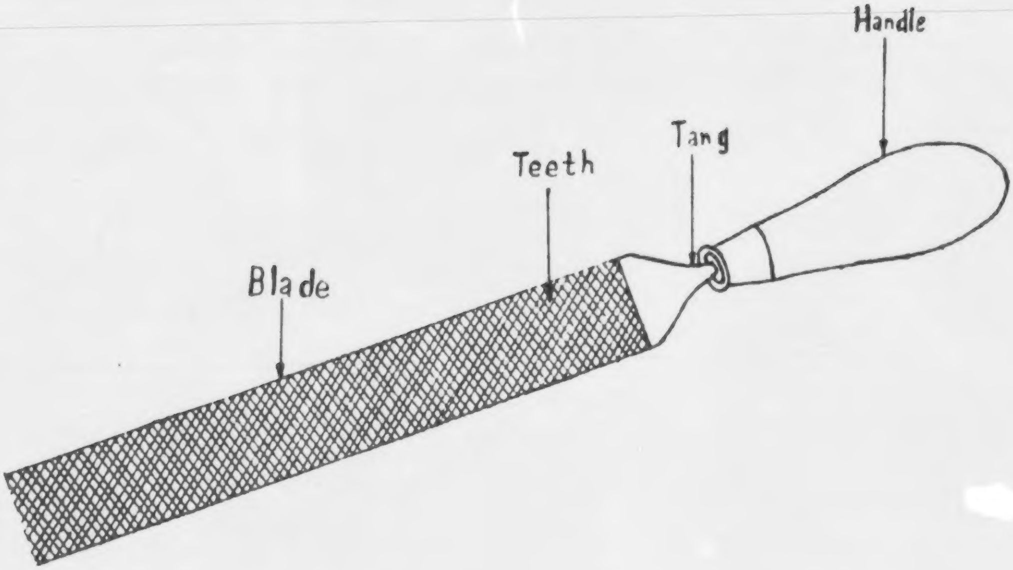


These are **STEEL TAPES** and are used for quick, easy measuring. When you're finished using them, the tape goes back inside until you need it again. It stays in the dark like a turtle in his shell.



1. Wood burners are made to burn. They can even burn fingers. Don't touch the heating element or tip while using them.
2. Don't lay the heating element or tip on anything that will burn or melt (such as wood or plastic).
3. The tip and heating element must be rested on a metal holder.
4. Don't lay the heating element or tip on the cord. When it burns through the cord, there will be an electrical explosion.
5. Don't lay the hot iron in a place where someone can sit or lean on it.
6. Let the iron cool completely before it is stored.
7. Don't try to catch a falling wood burner.
8. If dropped, the wood burner will break.
9. Don't use heavy pressure on the tip. It will break.
10. Be careful when plugging and unplugging the wood burner. Don't touch the plug prongs.

WOOD BURNERS are for Burning designs in wood and other soft materials



1. Never use a file without a handle. The sharp tang will cause punctures to the hand.
2. Never use a file as a pry bar or hammering device. File metal is extremely hard and brittle. If it breaks, it could throw out small, sharp pieces of steel.
3. Discard any file that has blade chips or is dull.
4. Filing should be done with the material clamped in a vise or some other clamping device.
5. Some files are made for working with wood, some for metal work, and some for plastic work. There are many types of files for many kinds of smoothing operations. BE SURE TO HAVE THE CORRECT FILE FOR EACH JOB. (For instance--it is not safe to use a wood rasp on metal.)

FILES are for smoothing
wood, plastic, and
metal surfaces

There are lots of other things in the carpenter's box.

But these tools are the important ones because you can build most things with them.

Oops, we almost forgot-- the careless Carpenter has another box too........

A box of band-aids !!

It's **VERY** important!

BE SAFE !!!

REFERENCES

Geil, J. A Guide to Using Tools in the Elementary Classroom, Stanley Tool Company.

Geil. J, A New Point of View, Stanley Tool Company

Point of View Elementary School Industrial Arts, Stanley Tool Company.

Stanley Tool Guide, Stanley Tool Company.

The Little Carpenter, Stanley Tool Company.

HAND-HELD TOOLS AND UTENSILS FOR SECONDARY SCHOOL USE

GENERAL REQUIREMENTS

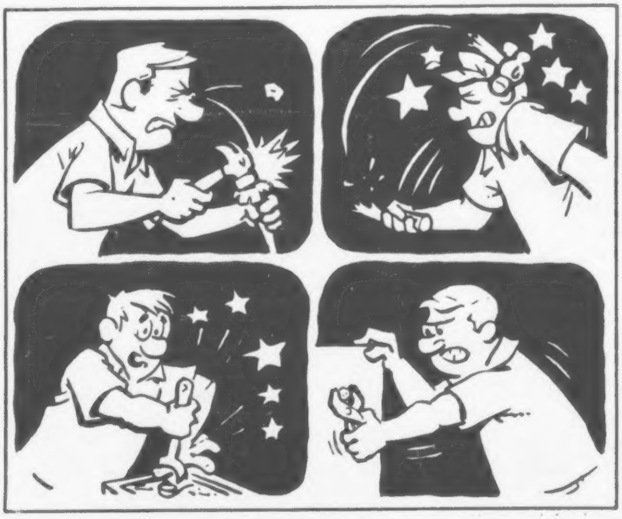
Each employer shall be responsible for the safe condition of tools and equipment used by employees, including tools and equipment which may be furnished by employees (OSHA/NIOSH).

To adapt this requirement to public school use, the following responsibilities have been defined.

The school district is responsible for purchasing tools and utensils (that comply with established standards for safety) through local budgeting procedures. After the tools and utensils are purchased, they are serviced or repaired by specialized craftsmen or product manufacturers.

The classroom teacher is responsible for daily surveying tools and utensils and recommending the repair or replacement of any item that is not functioning properly. The classroom teacher is also to supervise and teach his/her pupils in the safe use of hand tools and utensils.

The pupil is responsible for using the tool or utensil as he/she has been instructed by the teacher and informing the teacher if any item is broken or malfunctions while in use. Further, the pupil will not remove any hand tool or other item supplied by the school district from the school laboratory.



HAND TOOL SAFETY

GUIDE TO SELECTION AND PROPER USE

FOREWORD

Much has been written on the subject of Hand Tools. Most of the material is devoted to how-to-do-it information and does provide excellent instruction for professional, amateur, or home workshop uses. Unfortunately, some of this material contains information which may lead to hazardous misuse. Too little has clearly defined the uses for which particular tools are designed.

This section describes the various common and the principal specialized wrenches, pliers, striking and struck tools, screwdrivers, vises, clamps, snips, and tool boxes. This section defines the intended uses of these tools, cautions against misuse and abuse, and indicates when a tool should be repaired or retired from service and replaced with a new one for the sake of efficiency and safety.

This section is divided into ten units for easier reading and reference. Unit Five provides redressing instructions for those tools requiring redressing in normal use.

Two cartoon characters, "Hazardous Harry" and "Careful Cal," have been created to graphically emphasize the Do's and Don'ts that apply to hand tool use. Harry will illustrate some of the possible results of misuse and abuse. Cal will show the way a real pro does it. Cultivate Cal's methods ---- avoid Harry's.

Hand Tools Institute
707 Westchester Ave., White Plains, New York 10604

Prepared by the
Hand Tools Institute
with the cooperation and
assistance of member
manufacturers.

WRENCHES

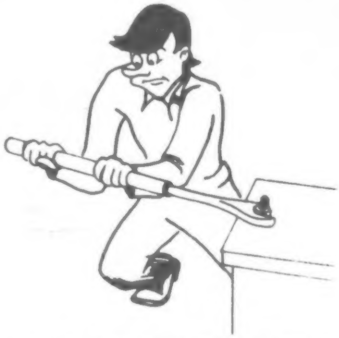
Wrenches are one of the most widely used hand tools. Their main function is holding and turning nuts, bolts, cap screws, plugs, and various threaded parts. Since a screw (thread) in use acts as a remorseless wedge, it is possible to strip threads or damage parts by applying excessive torque. Quality wrenches, regardless of their type, are therefore designed to keep leverage and intended load in safe balance.

Standard wrench types are available for almost every conceivable operation and service, with both American Standard and Metric openings. Special wrenches are also available for servicing and overhaul of certain widely used equipment. Today's mechanic need not improvise to find the proper tool for a particular job. This unit will guide him/her in selecting the proper tool.

BASIC SAFETY RULES WHICH APPLY TO THE USE OF WRENCHES

1. NEVER use a pipe extension or other form of "cheater" to increase the leverage of any wrench.

2. Select a wrench whose opening exactly fits the nut. Too large an opening can spread the jaws of an open-end wrench and batter the points of a box or socket wrench. Care should be exercised in selecting inch wrenches for inch fasteners and metric for metric fasteners.

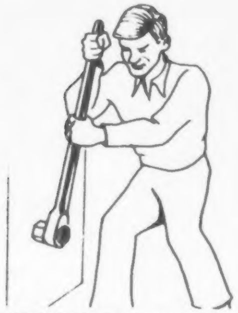


NEVER USE A LEVERAGE EXTENSION ON A WRENCH HANDLE.

WRONG

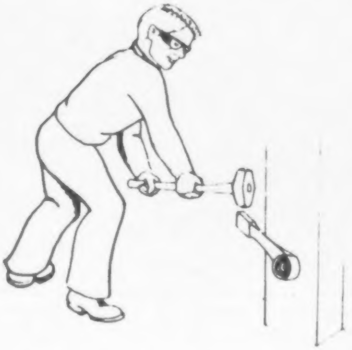
3. If possible, always PULL on a wrench handle and adjust one's stance to prevent a fall if something lets go.

4. The safest wrench is a box or socket type--particularly on hex nuts or fittings. Always use a straight, rather than an offset, handle if conditions permit.



ADJUST YOUR STANCE AND PULL WHEN APPLYING HIGH TORQUE.

RIGHT



WEAR SAFETY GOGGLES AND USE A HEAVY SLEDGE TYPE HAMMER.

RIGHT

5. To free a "frozen" nut or bolt, use a striking-face box wrench or a heavy-duty box or socket wrench. Application of penetrating oil beforehand is recommended.

6. NEVER cock an open-end wrench. Be sure the nut or bolt head is fully seated in the jaw opening.

7. Adjustable wrenches should be tightly adjusted to the nut and pulled so that force is on the side of the fixed jaw.

8. Avoid OVER TORQUING. A torque wrench will permit tightening to the exact torque required for best performance, economy, and safety.

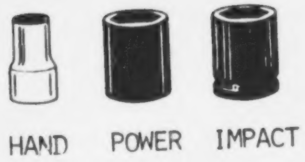
9. NEVER expose any wrench to excessive heat which may draw temper and ruin the tool.

10. Wrenches and pliers should not be ground to change their shape.

11. Periodic inspection of hand tools by competent personnel is a SAFETY MUST. Many types can be repaired by using the manufacturer's parts and repair kits and following the manufacturer's instructions.

12. WARNING. Ordinary plastic-dipped handles are designed for comfort--not electrical insulation. Tools having high dielectric insulation are available and are so identified. Do not confuse the two.

SOCKET WRENCHES

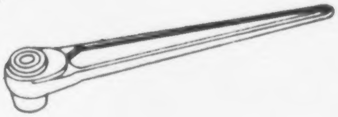


DESCRIPTION. There are three types of sockets--hand, power, and impact--all different in design and hardness. This unit is concerned with hand sockets, WHICH SHOULD NEVER BE USED ON POWER DRIVE OR IMPACT WRENCHES.

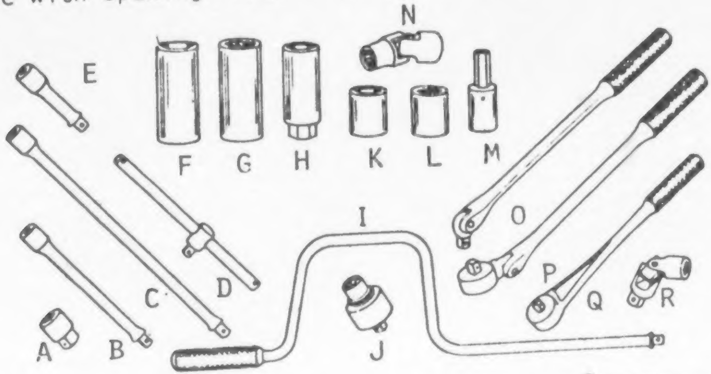
Hand socket wrenches are made in a wide range of sizes and capacities. All have square drives ranging from 1/4 inch to 1 inch. Drive size is a measure of capacity.

Sockets are made in regular depth and extra deep. Spark plug sockets have a rubber insert to hold the plug. Openings may be 12-, 8-, 6-point, or square.

Handle types include reversible ratchet, sliding tee, offset speeder, and flex head. Ratchets with dielectric insulation handles are available for linemen's use. Attachments include extension bars, adapters, flexible joints, and various bits such as hex, slotted, and Phillips screw, etc.

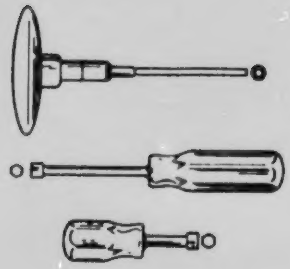


EXTRA HEAVY-DUTY RATCHET WRENCHES. These powerful wrenches are made in 24-, 36-, and 48-inch lengths. Both hex and square sockets are available with openings from 1 to 3 1/8 inches.



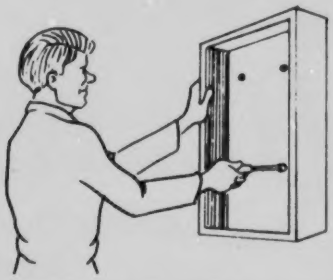
A - ADAPTER
B,C,E - EXTENSION BARS
D - SLIDING T HANDLE
F - DEEP 6-POINT SOCKET
G - DEEP 12-POINT SOCKET
H - SPARK PLUG SOCKET
I - SPEEDER HANDLE
J - RATCHET ADAPTER

K - REGULAR 6-POINT SOCKET
L - REGULAR 12-POINT SOCKET
M - HOLLOW SCREW SOCKET BIT
N - UNIVERSAL 12-POINT SOCKET
O - FLEX HANDLE
P - FLEX HEAD RATCHET
Q - REVERSIBLE RATCHET
R - UNIVERSAL JOINT



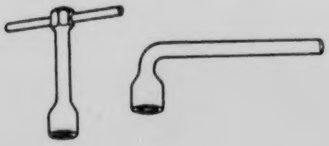
Nut Drivers. Nut drivers are screwdriver-type tools which, in their simplest form, have a one-piece shank and socket secured in a fixed handle. Socket heads have openings for hex nuts, bolts, and screws up to 3/4-inch nut size. Shafts may be solid, drilled part way, or full hollow--plain or magnetic for holding small fasteners.

Handles, both regular and reversible ratcheting, are available to accommodate interchangeable shanks for recessed head screws such as Phillips, Frearson, Hex, Spline, and Scrulox, and for slotted screws as well as for standard 1/4 inch-drive sockets.



NUT DRIVERS ARE EXCELLENT CLOSE-QUARTERS TOOLS.

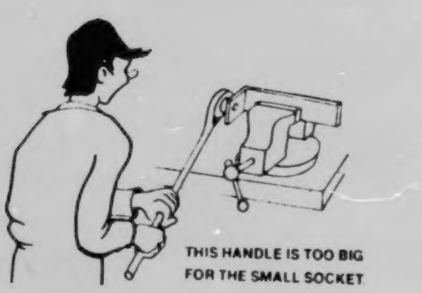
RIGHT



Non-Detachable Socket Wrenches. These wrenches have fixed openings, both hex and square, and are available in tee and off-set handle types.

Proper Uses. Since detachable socket wrenches provide an almost endless combination of handles, attachments, and sockets, it is possible to assemble a proper tool for almost any type of service within the tool's capacity.

Abuse/Misuse. Do not use pipe or other improvised leverage extensions on handles--go to a larger size wrench. When using adapters, remember that when adapting "down" (big handle, small socket) you build up tremendous torque potential. When adapting "up" (small handle, big socket) you lose turnpower. Always stay within safe limits "up or down". NEVER use hand sockets on power drive or impact wrenches.


THIS HANDLE IS TOO BIG
FOR THE SMALL SOCKET

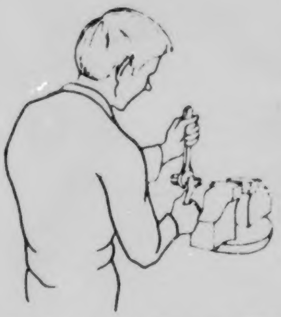
WRONG

WHEN TO REPAIR OR REPLACE. Practically all manufacturers supply parts, repair kits, and instructions for servicing their ratchet wrenches and handles. Periodic cleaning and inspection of handles, sockets, and attachments is very important. Repairs should be made with the manufacturer's own parts. Sockets with cracked walls, breaks, or battered points should be discarded.

COMBINATION BOX-OPEN-END WRENCHES

DESCRIPTION. The most widely used patterns are made in long and short types having a 15 degree angle open end and a 12-point box opening of the same size opposite. The box opening is offset at a 15 degree angle to the handle for clearance. Special service types include the following tools. The split box or flare nut pattern is for use on tube fittings and should not be used for high torque applications. This type has a 6- or 12-point opening offset 15 degrees from the plane of the handle with a tube opening slot at 22 1/2 degrees to the axis of the handle. This pattern is also available with openings of different size at each end. The electronic pattern is thinner and slimmer with a 15 degree hex box opening.

PROPER USES. Combination box-open-end wrenches are designed for a wide variety of work. Their box opening adds still more to their versatility and strength. The flare nut pattern, with its hex box opening, is especially useful in air conditioning and refrigeration work where tubing terminates on flare nuts. The thinner and slimmer electronic pattern is designed for work where access and clearance are limited.



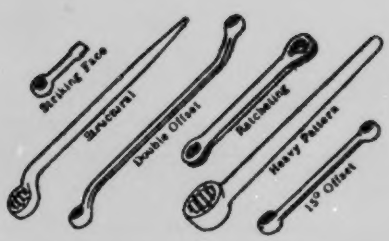
USE A SPLIT BOX WRENCH ON FLARE NUTS

RIGHT

ABUSE/MISUSE. Do not use the open end of these wrenches to free a "frozen" nut or to do the final tightening of a hex nut. Use the box opening. NEVER use an extension on the wrench handle.

WHEN TO REPAIR OR REPLACE. Attempts to repair box-open-end wrenches are not recommended. Discard any wrench with spread, nicked, or battered jaws on the open end, or rounded or damaged points on the box end. Discard wrenches with bent handles.

BOX WRENCHES

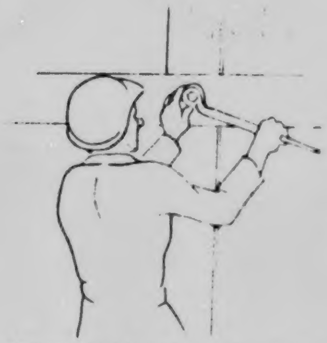


DESCRIPTION. Box wrenches are made in long, short, and electronic patterns with double offset and 15 degree angle offsets. Twelve point, hex, and square openings are available in regular and heavy-duty patterns. Double head types have different openings in each head. The ratcheting type has both hex and 12-point openings. The structural pattern is very similar to the open-end pattern except that it has a 12-point box opening. The striking face wrench is made in both straight and offset patterns with 12-point openings.

PROPER USES. Box wrenches in the regular pattern are designed for general service. The heavy-duty and striking face patterns are designed for the service indicated. The electronic hex box patterns are designed for the lighter service encountered in electronic, carburetor, and ignition work. Ratcheting box and split box wrenches are for light duty and should not be used in heavy-duty applications.

ABUSE/MISUSE. NEVER use a hammer on any wrench other than a striking face wrench. Use a sledge type hammer. ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES, NEVER use an extension on the wrench handle.

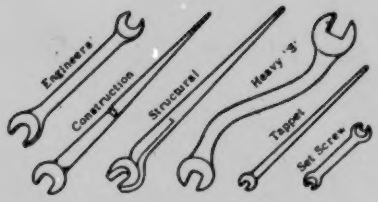
WHEN TO REPAIR OR REPLACE. Attempts to repair box wrenches are not recommended. Discard any wrench with broken or battered points.



THE STRUCTURAL BOX WRENCH IS THE SAFEST TOOL THE STEELWORKER CAN USE

RIGHT

OPEN-END WRENCHES



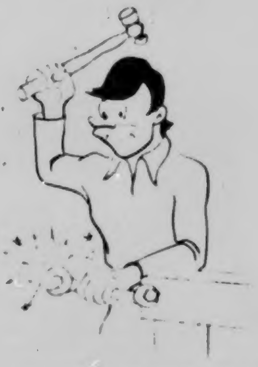
DESCRIPTION. The most widely used open-end wrenches are made with openings at a 15-degree angle, which permits the complete rotation of hex nuts in a 30-degree swing by flopping the wrench. They are available in both single and double head patterns. Double head patterns have different openings in each head.

In addition to the above popular patterns, open-end wrenches are made for special types of service. Electronic wrenches are thinner and have openings set at 15 degrees and 60 degrees (or 75 degrees) to the center line of the handle. Ignition wrenches are small, thin wrenches having openings at 15 degrees and 60 degrees. Tappet wrenches, both single and double head, have openings at 15-degree angles and are longer and thinner. Construction wrenches have a single 15-degree opening and a drift handle for aligning bolt holes. Structural wrenches are similar to the construction pattern except they have straight openings and an offset handle. Check nut wrenches are thinner. Set screw and heavy "S" wrenches have openings at a 22 1/2-degree, rather than a 15-degree, angle.

PROPER USES. Open-end wrenches are designed for a wide variety of work. Special patterns are intended for the type of service which their name implies; e.g., tappet, ignition, check nut, structural, etc.

ABUSE/MISUSE. Do not use an open-end wrench to free a "frozen" nut or to do the final tightening of a nut. Use a socket or box wrench because they are stronger. NEVER use a hammer on this type of wrench. NEVER use an extension on the handle.

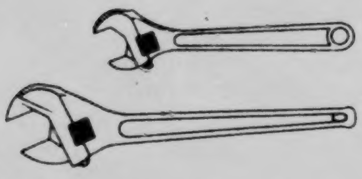
WHEN TO REPAIR OR REPLACE. Attempts to repair open-end wrenches are not recommended. Discard any wrench with spread, nicked, or battered jaws, or bent handle.



DON'T HAMMER ON THIS WRENCH

WRONG

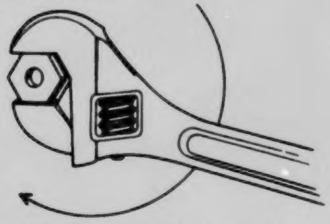
ADJUSTABLE WRENCHES



DESCRIPTION. Regular pattern adjustable wrenches are available in lengths from 4 to 24 inches. Locking adjustables are usually made in 6- thru 12-inch lengths.

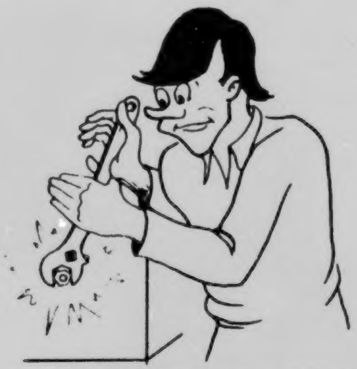
PROPER USES. Adjustable wrenches are designed to provide a wide range of capacity in a single tool and are a convenient wrench for service and repairmen, linemen, etc. They are not intended to replace fixed opening wrenches for production or general service work. High dielectric insulation handle types are widely used by linemen and other electrical workers. WARNING. Ordinary plastic-dipped handles are for comfort only, NOT ELECTRICAL INSULATION.

Adjustable wrenches should be tightly adjusted to the nut and pulled so that the force is on the side of the fixed jaw.



ABUSE/MISUSE. Do not use an adjustable wrench to free a "frozen" nut or to do the final tightening of a nut. NEVER pull on a loosely adjusted wrench. NEVER use a hammer or extension on this wrench.

WHEN TO REPAIR OR REPLACE. Practically all manufacturers supply parts assortments, repair kits, and instructions for their adjustable wrenches. Periodic inspections should be made to detect damaged jaws, knurls, pins, and springs. Damaged parts should be replaced. Discard any wrench with spread or damaged fixed jaw or bent handle.

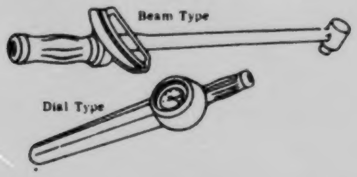


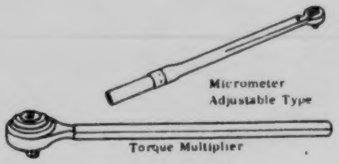
THIS LOOSELY ADJUSTED WRENCH CAN DAMAGE THE NUT, WRENCH AND HARRY

WRONG

TORQUE WRENCHES

GENERAL. Torque wrenches are designed to permit an operator to determine applied torque on bolts, nuts, and other fasteners. They measure torque in ounce-inches, pound-inches, and pound-feet, as well as in metric measure. However, many manufacturers express torque in foot-pounds (rather than pound-feet), since this nomenclature is more familiar to the average tool user. Metric measure torque wrenches are available in mkg and cmkg.



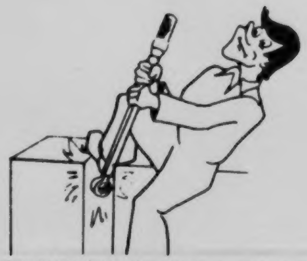


DESCRIPTION. Two methods are used to indicate measured torque. A type widely used in production assembly signals applied torque by momentarily releasing and sounding an audible signal when the set torque is reached. Torque value is set to a micrometer scale on the handle or preset by an adjusting screw in the handle cavity (which precludes accidental resetting). Torque screwdrivers operate the same as the above wrench type except that they release when the set torque is reached.

A second type indicates, rather than signals, torque. Applied torque is indicated on a dial, calibrated scale, or by electric light signal. Some models have memory pointers which remain at the maximum reading attained until manually reset. The most widely used torque wrenches have square drives to utilize standard detachable sockets. Both ratcheting and non-ratcheting types are available.

TORQUE MULTIPLIERS. Torque multipliers are multi-geared tools generally used with ratchets or ratcheting torque wrenches as the drive component. Input is multiplied through the gearing four or more times, depending on the model used. A reaction bar, which locks into the head of the torque multiplier, must rest securely against an object sturdy enough to withstand the force that will be generated. When driving a torque multiplier with a torque wrench, a torque loss factor at the fastener, caused by frictional losses through the gear train, must be taken into consideration in determining the desired torque at the output side of the torque multiplier. Torque loss factors are available from most torque tool manufacturers. Torque wrenches that can be used between the output side of the torque multiplier and the fastener are also available. When used in this manner, the actual torque on the fastener may be read without the need to compensate for frictional loss.

PROPER USES. Torque wrenches are used in various operations where proper torquing of nuts, bolts, and other fasteners is critical. Such operations include assembly and inspection of gear trains and bearings, setting of clutches and brakes, maintenance repair, overhaul, and experimental work.



HARRY SHOULD PRY WITH A CROW BAR – NOT A TORQUE WRENCH.

WRONG

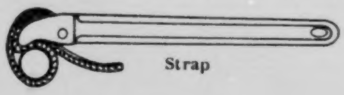
Always work with clean threads that are free of corrosion. It is important to follow the product manufacturer's instructions for specific torque loadings--particularly when recommendations are for dry, oiled, or plated threads, and when there are other instructions which apply to a particular tool. Avoid overtightening a nut or bolt with a conventional wrench before applying a torque wrench. When not in use, the adjustable type wrench should be set to the lowest torque.

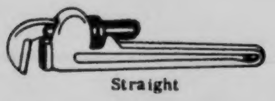
ABUSE/MISUSE. A torque wrench is a precision instrument and should not be roughly handled. NEVER use it as a hammer, a pry, or as a conventional wrench--use it only as a torque tool. Avoid dropping.

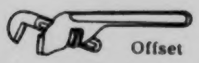
WHEN TO REPAIR OR REPLACE. If a torque wrench has been dropped it should be checked on a torque tester before use. Torque wrenches should be periodically checked for calibration accuracy when in frequent or continuous service. Most manufacturers provide repair and calibration service. The manufacturer will advise if the tool can be repaired or should be replaced.

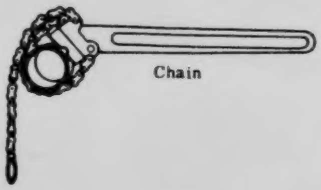
PIPE WRENCHES

DESCRIPTION. The most widely used type of pipe wrench is illustrated in straight and offset handle patterns. Most have fixed teeth on the hook jaw and replaceable teeth on the heel jaw. Pipe capacities usually range from 3/8-inch to 8 inches. The strap wrench is intended for use on polished or specially finished pipe to avoid marring the surface. The chain wrench is designed for the same service as the jaw type.

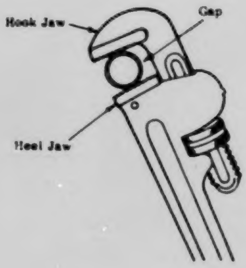

Strap

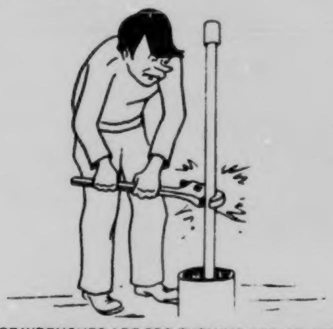

Straight


Offset


Chain

PROPER USES. The jaw and chain type wrenches are designed for turning and holding pipe fittings, within their capacities, in service where tooth marks are not objectionable. To avoid tooth marks, use the strap wrench. In using the jaw type wrench, it is important to maintain a gap between the back of the hook jaw and the pipe. This concentrates the pressure at two points only and produces the maximum gripping action and rotating force. The offset handle pattern is ideal for close quarters where the normal swing of a straight handle pattern is limited. If possible, always pull rather than push on the wrench handle.



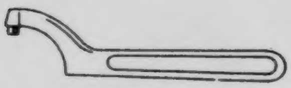

PIPE WRENCHES ARE FOR TURNING AND HOLDING – NOT FOR LIFTING OR BENDING.

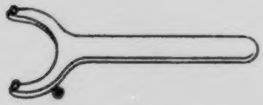
WRONG

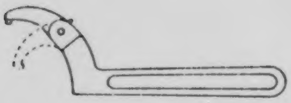
ABUSE/MISUSE. NEVER use a pipe wrench to bend, raise, or lift a pipe. NEVER use an extension on the handle. NEVER hammer on, or with, a pipe wrench.

WHEN TO REPAIR OR REPLACE. Practically all manufacturers supply repair parts and instructions for their wrenches. Periodic cleaning and inspections should be made to detect worn or unsafe parts, and damaged parts should be replaced. Replacement pins and chains are available for chain wrenches and replacement straps for strap wrenches. Discard any wrench with bent handle or broken housing.

SPANNER WRENCHES







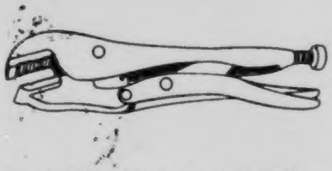
DESCRIPTION. Spanner wrenches are made in a variety of patterns as illustrated.

PROPER USES. Spanner wrenches are basically a machine shop tool. They are used on machine tools for adjusting collars, lock nuts, rings, spindle bearings, face plate draw nuts, etc.

ABUSE/MISUSE. Do not hammer on the wrench handle. Do not use an extension on the handle.

WHEN TO REPAIR OR REPLACE. Attempts to repair these wrenches are not recommended. If pins, hooks, or forging is bent, deformed, or cracked, discard the tool.

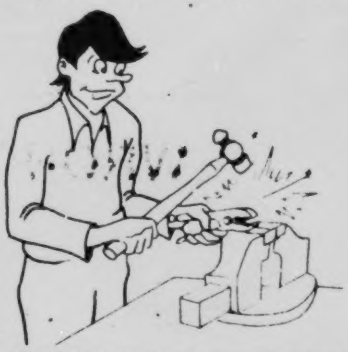
LOCKING PLIER-WRENCHES AND CLAMPS



DESCRIPTION. Locking plier-wrenches are available in a variety of sizes, and with straight or curved jaws. Compound leverage systems lock jaws and hold various shapes and sizes of work.

PROPER USES. These wrenches are combination tools which function as pliers, wrenches, portable vises, or clamps. They are not intended to replace open-end or box wrenches because of the possible damage to the fitting or fastener.

ABUSE/MISUSE. Do not hammer to tighten jaws or to cut wire or bolts. Do not expose wrenches or clamps to heat from welding electrodes. When subjected to severe vibration, such as that encountered during riveting, locking wrenches or clamps holding the work pieces should be wired or taped closed to prevent accidental opening. Do not use pipe, other extensions, or hammering to increase torque applied to these tools. They should NEVER be used as steps or ladders to support personnel.



DON'T HAMMER ON THIS PLIER-WRENCH TO CUT WIRE OR BOLTS.

WRONG

WHEN TO REPAIR OR REPLACE. Avoid excessive wear on working parts by frequent lubrication. Attempts to repair these tools are not recommended. Discard any damaged tool.

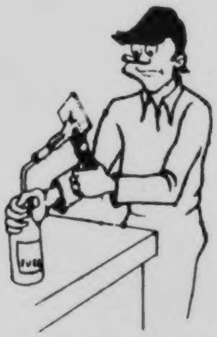
PLIERS

Pliers of various types are used by practically all mechanics, both amateur and professional. There are many types and sizes. Each one is designed for specific uses, although their versatility makes some pliers adaptable for many jobs. Choose the right pliers for the job.

Basic Safety Rules Which Apply to the Use of Pliers

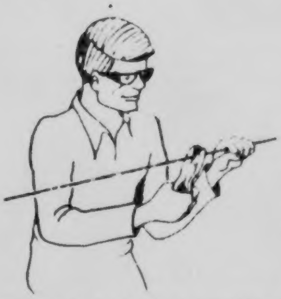
1. Pliers should not be used for cutting hardened wire, unless specifically manufactured for this service.

2. NEVER expose pliers to excessive heat. This may draw the temper and ruin the tool.



NEVER EXPOSE PLIERS TO EXCESSIVE HEAT.

WRONG



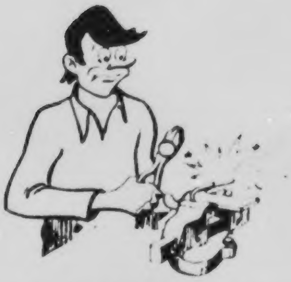
ALWAYS CUT AT RIGHT ANGLES – DON'T ROCK SIDE TO SIDE WHEN CUTTING WIRE.

RIGHT

3. Always cut at right angles. NEVER rock from side to side or bend the wire back and forth against the cutting blades.

4. Don't bend stiff wire with light pliers. Needle nose pliers can be damaged by using the tips to bend too large a wire. Use a sturdier tool.

5. NEVER use pliers as a hammer nor hammer on the handles. They may crack or break, or blades may be nicked by such abuse.



PLIERS ARE NOT MADE FOR HAMMERING

WRONG

6. NEVER extend the length of handles to secure greater leverage. Use a larger pair of pliers or a bolt cutter.

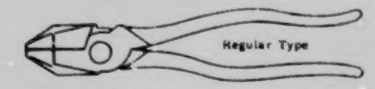
7. Pliers should not be used on nuts or bolts. A wrench will do the job better and with less risk of damage to the fastener.

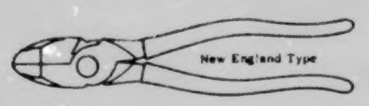
8. Oil pliers occasionally. A drop of oil at the hinge will lengthen the tool life and assure easy operation.

9. Safety glasses should be worn when cutting wire, etc., to protect eyes from being struck by the end of the object being cut.

10. WARNING: Ordinary plastic-dipped handles are designed for comfort--not electrical insulation. Tools having high dielectric insulation are available and are so identified. Do not confuse the two.

LINEMEN'S SIDE CUTTING PLIERS

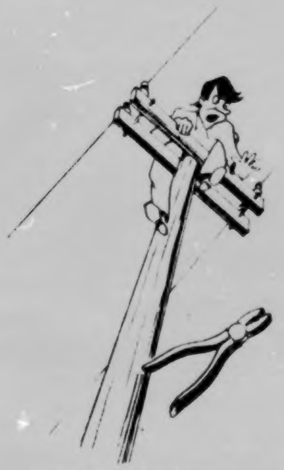




DESCRIPTION. Two head patterns are available: standard and New England (which is more streamlined). Handles may be plain, slip-on molded plastic, plastic-dipped, or high dielectric insulated. High leverage patterns are also available, as are pliers incorporating sleeve twisters and threaded bolt-holding openings. Sizes range from 5 to 9 1/4 inches in length.

PROPER USES. These are heavy-duty tools designed for the professional mechanic engaged in electrical, communications, and construction work.

ABUSE/MISUSE. NEVER expose pliers to excessive heat. Don't rock pliers from side to side when cutting wire. Always cut at right angles. NEVER use pliers as a hammer, or drop on hard or paved surfaces.

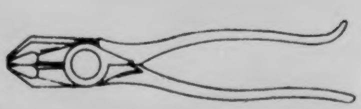


DON'T DROP PLIERS ON HARD OR PAVED SURFACES

WRONG

WHEN TO REPAIR OR REPLACE. Attempts to repair these pliers are not recommended. Discard any plier which is cracked, broken, sprung, or has nicked cutting blades. Dull cutting edges may be touched up with a small, medium-grade honing stone. Knurl inside nose may be cleared of foreign materials by brushing with a file card or stiff wire brush.

IRONWORKERS' PLIERS



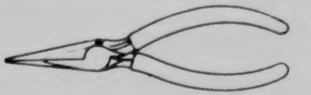
DESCRIPTION. These pliers are very similar to linemen's pliers, except that they have a hook bend on one handle and have a coil spring to hold the jaws open. Sizes range from 7 to 9 inches in length. Available in standard and high leverage patterns.

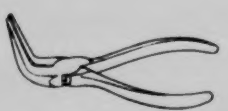
PROPER USES. These wire cutting pliers are designed for typing concrete reinforcing bars and form work involving pulling, twisting, and cutting wire.

ABUSE/MISUSE. NEVER expose pliers to excessive heat. Don't rock pliers from side to side when cutting wire. Always cut at right angles. NEVER use pliers as a hammer or drop on hard or paved surfaces.

WHEN TO REPAIR OR REPLACE. Attempts to repair these pliers are not recommended. Discard any plier which is cracked, broken, sprung, or has nicked cutting blades. Dull cutting edges may be touched up with a small, medium-grade honing stone. Knurl inside nose may be cleared of foreign materials by brushing with a file card or stiff wire brush.

LONG NOSE PLIERS

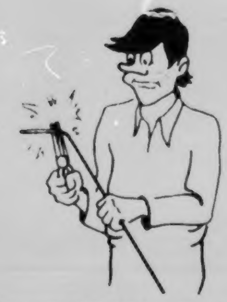




DESCRIPTION. This type of plier embraces three nose configurations: needle, round, and chain. They are available with and without side cutters and with cutters notched for stripping insulated wire. Small and miniature sizes are designed for electronic work. Handles may be plain, slip-on plastic, or dipped. Certain patterns are made in both straight and curved-nose design. Sizes range from 4 to 8 inches in length.

PROPER USES. Most long nose pliers are designed for electrical, telephone, and electronic work involving the smaller wire gauges. They will reach into awkward places and perform work difficult with any other tool. Their usefulness, however, is not limited to wire work.

ABUSE/MISUSE. NEVER expose these pliers to excessive heat. Don't bend stiff wire with the plier tip. NEVER rock from side to side when cutting. Cut at right angle to the wire. NEVER pry with the plier nose.

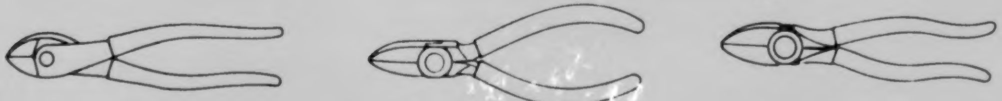


DON'T BEND STIFF WIRE WITH THE PLIER TIP

WRONG

WHEN TO REPAIR OR REPLACE. Attempts to repair these pliers are not recommended. Discard any plier which is cracked, broken, sprung, or has nicked cutting blades. Dull cutting edges may be touched up with a small, medium-grade honing stone. Knurl inside nose may be cleared of foreign materials by brushing with a file card or stiff wire brush.

DIAGONAL CUTTING PLIERS

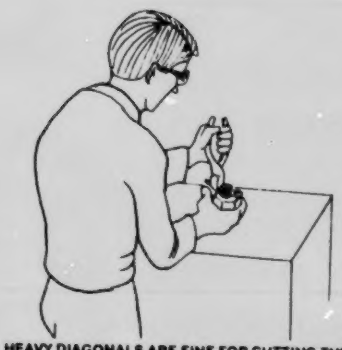


DESCRIPTION. Diagonal cutters are made in several patterns ranging from the high leverage, heavy-duty pattern down to the midget pattern for electronic work. They are available with and without a top bevel on the knives for flush cutting. Some have wire skinning holes--some have coil springs to open the jaws. Handles may be plastic-dipped, slip-on molder plastic, or plain. Sizes range from 4 to 8 inches in length.

PROPER USES. Diagonal cutting pliers are designed for electrical, electronic, telephone, general, and automotive work involving cutting and skinning wire, cutting and removing cotter pins, nails, and other fasteners.

ABUSE/MISUSE. NEVER expose pliers to excessive heat. Don't rock pliers from side to side when cutting wire. Always cut at right angles. **NEVER** use pliers as a hammer, or drop on hard or paved surfaces.

WHEN TO REPAIR OR REPLACE.
Attempts to repair these pliers are not recommended. Discard any plier which is cracked, broken, sprung, or has nicked cutting blades. Dull cutting edges may be touched up with a small, medium-grade honing stone.

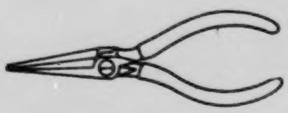


HEAVY DIAGONALS ARE FINE FOR CUTTING THE SPREAD ENDS OF COTTER PINS.

RIGHT

FLAT NOSE PLIERS

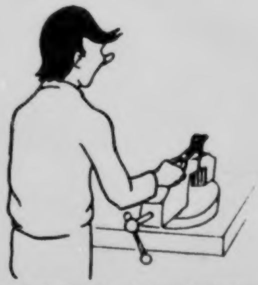
DESCRIPTION. Often referred to as "duck bill", these pliers have a flat nose in various widths. They are available with plain or plastic-dipped handles in sizes from 4 1/2 to 8 inches in length.



PROPER USES. Flat-nose pliers have diverse uses in the electrical, telephone, electronic, and other fields. They are extensively used in typewriter repair and assembly work and in textile weaving and knitting operations.

ABUSE/MISUSE. **NEVER** expose these pliers to excessive heat. Do not use as a hammer or as a pry.

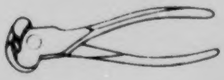
WHEN TO REPAIR OR REPLACE. Attempts to repair these pliers are not recommended. Discard any plier that is cracked, broken, or sprung.

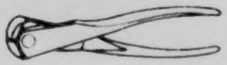


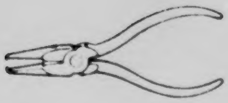
DON'T USE FLAT NOSE PLIERS TO PRY OR TWIST.

WRONG

End Cutting Pliers





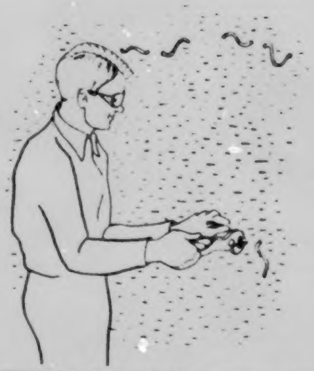


Description. End cutting pliers, or nippers, range in size from the heavy-duty, high leverage pattern down to the traverse end cutter designed for precision electronic work. Many are available with plain or plastic-dipped handles. Sizes range from 4 1/2 to 8 inches in length.

Proper Uses. End cutting pliers are designed for cutting wire, nails, rivets, etc.--close to work.

Abuse/Misuse. **Never** expose these pliers to excessive heat. **Never** use as a hammer.

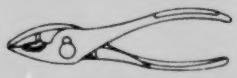
When to Repair or Replace. Attempts to repair these pliers are not recommended. Discard any plier which is cracked, broken, sprung, or has nicked cutting blades. Dull cutting edges may be touched with a small, medium-honing stone.

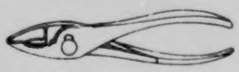


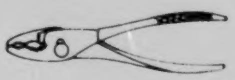
END CUTTERS ARE IDEAL FOR CUTTING TIE WIRES CLOSE TO THE CONCRETE WALL.

RIGHT

Slip Joint Pliers







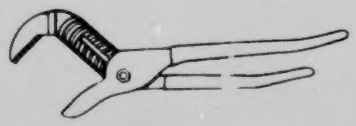
Description. These widely used pliers are available in several patterns: standard, thin nose, bent nose, and heavy-duty. Their slip joint capability increases the capacity range. Available with or without wire cutters in sizes from 5 to 10 inches in length.

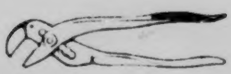
Proper Uses. These versatile tools are designed for a wide range of service involving gripping, turning, and bending.

Abuse/Misuse. **Never** expose these pliers to excessive heat. **Never** use as a hammer.

When to Repair or Replace. Attempts to repair these pliers are not recommended. Discard any plier that is cracked, broken, or sprung.

UTILITY PLIERS



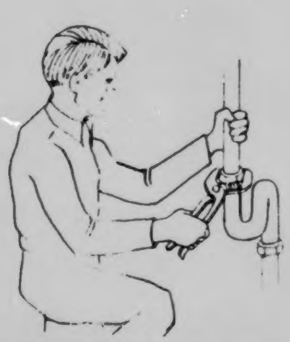


DESCRIPTION. These wide-range capacity pliers are made with both the tongue and groove adjustment design and a multi-position slip joint adjustment. Jaw capacities up to 4 1/4 inches are available. Jaws may be smooth, straight, or curved-toothed. Sizes range from 4 1/2 to 16 inches in length.

PROPER USES. These pliers are widely used by plumbers, electricians, auto mechanics, and mechanics in the construction and industrial fields. They will grip round, square, flat, and hexagonal objects and are capable of applying limited torque without damage to the work.

ABUSE/MISUSE. **NEVER** expose these pliers to excessive heat. **NEVER** use as a hammer.

WHEN TO REPAIR OR REPLACE. Attempts to repair these pliers are not recommended. Discard any plier that is cracked, broken, or sprung.



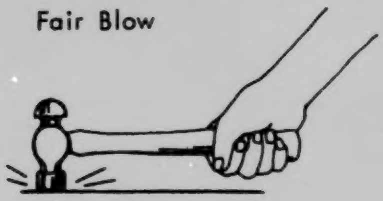
PLUMBERS HAVE MANY JOBS [illegible]RE UTILITY PLIERS ARE IDEAL

RIGHT

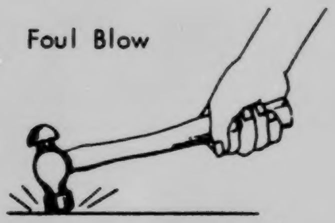
STRIKING TOOLS

Hammers and other striking tools are perhaps the most widely used, and probably the most often abused, of all hand tools. They are made in various types and sizes, with varying degrees of hardness and different configurations for specific purposes. They should be selected for their intended use and used only for those purposes. Proper use of all striking tools involves certain basic rules.

1. A hammer blow should always be struck squarely with the hammer striking face parallel to the surface being struck. Always avoid glancing blows and over and under strikes.

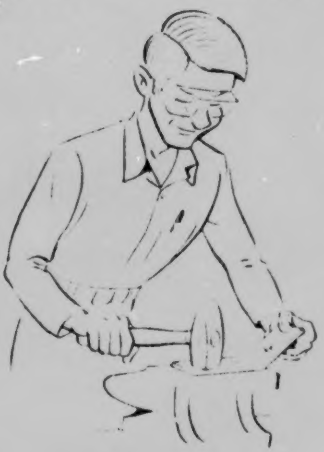


Fair Blow



Foul Blow

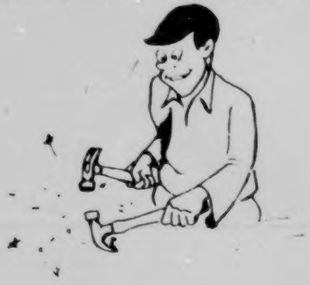
2. When striking another tool, (chisel, punch, wedge, etc.), the striking face of the hammer should have a diameter approximately 3/8 inch larger than the struck face of the tool. (See illustration on pg.   )



RIGHT

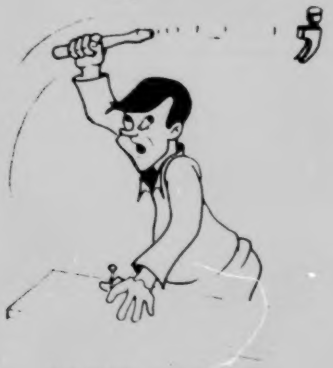
3. Always use a hammer of suitable size and weight for the job. Don't use a tack hammer to drive a spike, nor a sledge to drive a tack.

4. Never use one hammer to strike another hammer.



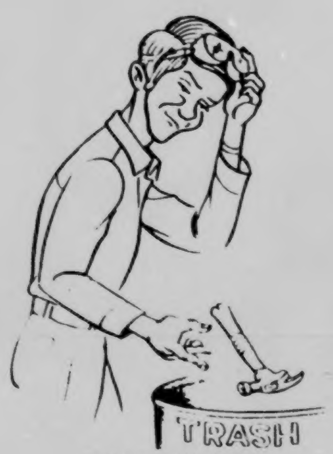
WRONG

5. Never use a striking or struck tool with loose or damaged handle.



WRONG

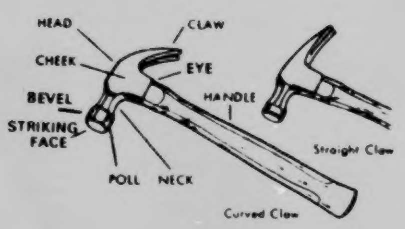
6. Discard any striking or struck tool if the tool shows dents, cracks, chips, mushrooming, or excessive wear.



RIGHT

7. Never redress striking tools.

NAIL HAMMERS

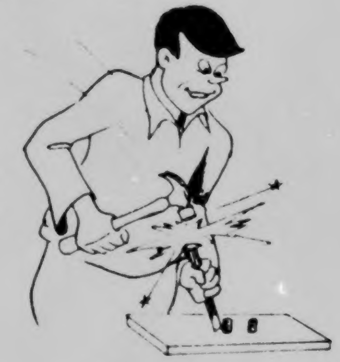


DESCRIPTION. Nail hammers are made in two patterns; curved claw and straight or ripping claw. The face is slightly crowned, with the edges beveled, although certain heavy-duty patterns may have checkered faces designed to reduce glancing blows and flying nails. Handles may be wood, tubular or solid steel, or fiberglass. Tubular steel, solid steel, and fiberglass are generally furnished with rubber-type grips which are also occasionally used on wood handles.

PROPER USES. Nail hammers are designed for driving common and finishing nails and nail sets, using the center of the hammer face. The claws are for pulling common and finishing nails and ripping woodwork, and should not be struck against metal.

ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

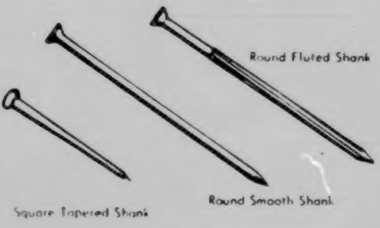
ABUSE/MISUSE. NEVER strike one hammer with another hammer. NEVER strike chisels or other hard objects with a nail hammer as the hammer may chip and possibly result not only in damage to the hammer, but also in eye or other bodily injury. NEVER use a hammer with a loose or damaged handle. NEVER strike with the side or cheek of a hammer.



WRONG

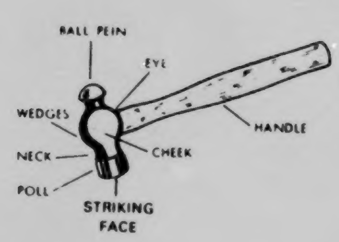
WARNING: Hardened steel-cut and masonry nails should never be driven with a nail hammer. These nails shatter under the force of an indirect or glancing blow and should NEVER be driven unless safety goggles are worn. When not driven through a piece of wood, a hole should be started with a small star drill or masonry bit. A hand drilling hammer or sledge is the proper tool to use.

WHEN TO REPLACE. Discard any hammer if the striking face or its bevel shows dents, chips, mushrooming, or is excessively worn; or if the claws show indentations or nicks inside the nail slot, or if the claw is broken. If only the handle is damaged, replace it with an equivalent new handle.



Hardened Nails

BALL PEIN HAMMERS



DESCRIPTION. Ball pein hammers are one of the most commonly used hammers. They have a rounded, slightly-crowned striking face with beveled edges and round, ball-shaped pein. Handles may be wood, solid steel, or fiberglass. The solid steel and fiberglass types are generally furnished with rubber-type grips which are also occasionally used on wood handles.

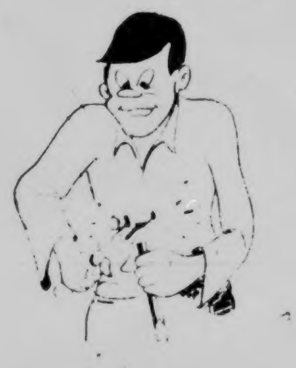
PROPER USES. Ball pein hammers of the proper size are designed for striking chisels and punches, and for riveting, shaping, and straightening unhardened metal.

When striking a struck tool (chisel or punch) the striking face of the hammer should have a diameter at least 3/8 inch larger than the struck face of the tool.

A hammer blow should always be struck squarely, with the hammer striking face parallel to the surface being struck. Always avoid glancing blows.

ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

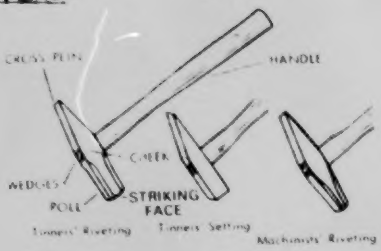
ABUSE/MISUSE. NEVER use a hammer with a loose or damaged handle. Avoid glancing blows to minimize chipping of the hammer. NEVER strike with the side or cheek of the hammer.



WHEN TO REPLACE. Discard any hammer if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

WRONG

RIVETING AND SETTING HAMMERS



DESCRIPTION. These hammers are designed for use by machinists and tinners. The handles are usually wood. The machinists' riveting hammer has a round poll with a slightly beveled, flat striking face and rounded cross pein. The tinners' riveting hammer has an octagon poll with a flat striking face and slightly beveled edges. The cross pein is slightly rounded. The tinners' setting or paneing hammer's face has sharp corners and bevels. The cross pein has a sharp beveled edge.

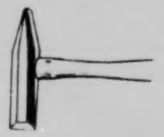
PROPER USES. The riveting hammer is designed for driving and spreading rivets on sheet metal work. The setting hammer is designed for forming sharp corners, closing and peining seams and lock edges, and for use by glaziers for inserting glazier points.

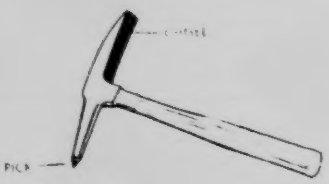
ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

ABUSE/MISUSE. NEVER use these hammers for general purpose work--they are strictly specialized tools. The square, sharp corners and sides of the setting hammer make it vulnerable to chipping if incorrectly used. NEVER use a hammer with a loose or damaged handle.

WHEN TO REPLACE. Discard any hammer if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

SCALING OR CHIPPING HAMMERS





DESCRIPTION. Scaling or chipping hammers are special-purpose tools and are made in varying configurations by different manufacturers. The two patterns illustrated are typical.

PROPER USES. These hammers are popular in iron foundries and in welding shops. They are designed for chipping welds, scale, rust, and paint from unhardened metal.

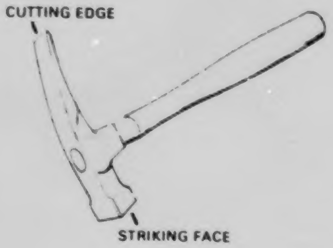
ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

ABUSE/MISUSE. **NEVER** use these hammers for any but the above purposes. **NEVER** use a hammer with a loose or damaged handle.

WHEN TO REPLACE. Discard any hammer if it shows dents, cracks, chips, mushrooming, excessive wear, or dulling. If only the handle is damaged, replace it with an equivalent new handle.

BRICKLAYERS' HAMMERS



DESCRIPTION. Bricklayers' hammers are special-purpose tools. The striking face is flat with beveled edges. The blade has a sharp, hardened cutting edge. Handles may be wood, solid steel, or fiberglass, and may be furnished with rubber-type grips.

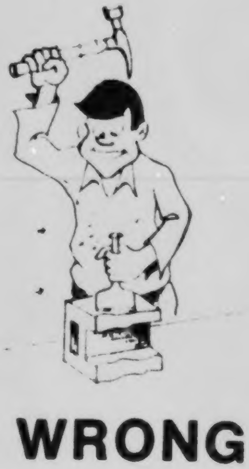
PROPER USES. Bricklayers' hammers are designed for setting and cutting (splitting) bricks, masonry tile, and concrete blocks, and for chipping mortar from bricks.

ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

ABUSE/MISUSE. **NEVER** use these tools to strike metal or to drive struck tools (including brick sets and chisels). (Use a ball pein of the proper size* or a hand drilling hammer.)

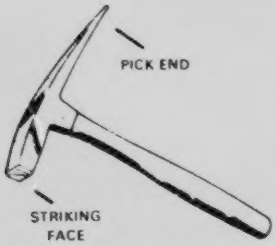
WHEN TO REPLACE. Discard any hammer if it shows dents, cracks, chips, mushrooming, excessive wear, or dulling. If only the handle is damaged, replace it with an equivalent new handle. The cutting edge may be redressed. See instructions in "Redressing Instructions" unit.



*Use a ball pein hammer with a striking face at least 3/8 inch larger than the struck face of the tool, or a hand drilling hammer.

ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

PROSPECTING PICKS



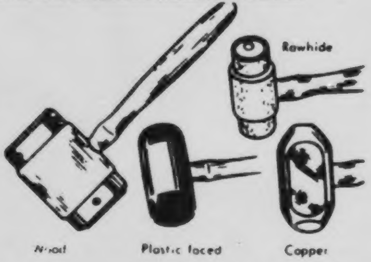
DESCRIPTION. These are special-purpose tools, used by geologists and prospectors. The striking face is flat with beveled edges. The long pick is well-pointed and may be either round or square. Handles may be wood, solid steel, or fiberglass and may be furnished with rubber grips.

PROPER USES. Prospecting picks are designed for splitting rock and for digging and prying out rock with the pick. The pick is also used as an aid in climbing.

ABUSE/MISUSE. NEVER use these tools to strike metal or to drive struck or hammered tools. NEVER use a pick with a loose or damaged handle.

WHEN TO REPLACE. Discard the pick if it shows dents, cracks, chips, mushrooming, excessive wear, or dulling. If only the handle is damaged, replace it with an equivalent new handle. The pick end may be redressed. See instructions in "Redressing Instructions" unit.

SOFT FACE AND NON-FERROUS HAMMERS AND MALLETS



DESCRIPTION. Soft face hammers and mallets are made of various non-ferrous materials (wood, rawhide, rubber, plastic, copper, brass, lead, etc.). Heads are cylindrically shaped with two flat striking faces. Handles are usually wood or fiberglass.

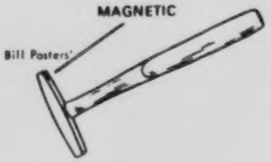
PROPER USES. Soft face hammers are intended for striking blows where steel hammers would mar or damage the surface of the work. Wooden mallets are properly used for striking wood and plastic-handled chisels, gouges, wood pins, and small stakes, and to form or shape sheet metal. Rubber and plastic hammers are used for setting stone. Plastic hammers usually have replaceable tips, available in varying degrees of hardness.

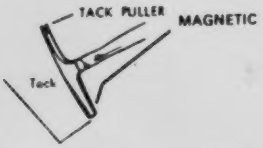
ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

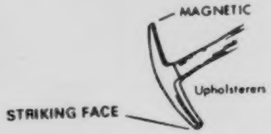
ABUSE/MISUSE. NEVER use these tools to drive nails or screws, or to strike sharp metal objects. NEVER use a hammer or mallet with a loose or damaged handle.

WHEN TO REPLACE. Discard any hammer or mallet if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

MAGNETIC HAMMERS







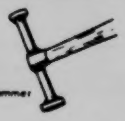
DESCRIPTION. Magnetic hammers are usually made in the patterns illustrated. One end of the head is magnetized to hold tacks. Handles are usually wood.

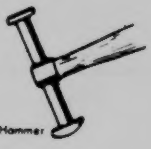
PROPER USES. Primary use of these light-duty hammers is holding and driving tacks. The tack hammer has a long thin claw for pulling tacks in corners and along walls. It is also used for removing light mouldings. The heads of the other two patterns are designed only for starting and driving tacks. The magnetic end is used for starting the tack, the opposite end is used for driving.

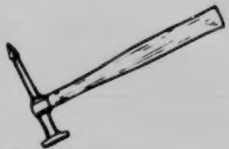
ABUSE/MISUSE. NEVER use these hammers for driving other than tacks and upholstery nails. NEVER use a hammer with a loose or damaged handle.

WHEN TO REPLACE. Discard any hammer if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

BODY AND FENDER HAMMERS


Dinging Hammer


Cross Pein Hammer


Pick Hammer

DESCRIPTION. Body and fender hammers are highly specialized tools used almost exclusively by skilled automotive repairmen. They are made in a great variety of configurations; the patterns illustrated being typical. Handles may be of wood or fiberglass.

PROPER USES. These hammers are designed for bumping and dinging sheet metal on and off the dolly in the repair of automotive bodies and fenders.

ALWAYS WEAR SAFETY GOGGLES

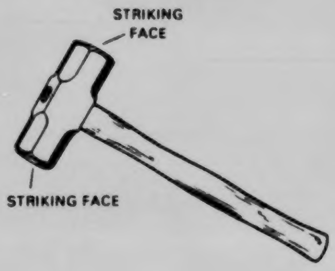
TO PROTECT THE EYES

ABUSE/MISUSE. NEVER use these hammers for other than the above specified purposes. NEVER use a hammer with a loose or damaged handle.

WHEN TO REPLACE. Discard any hammer if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

BLACKSMITHS' OR ENGINEERS' HAMMERS AND SLEDGES--DOUBLE FACE

DESCRIPTION. This is the most commonly used type of sledge hammer and is made in slightly different head configurations. All patterns have crowned striking faces with beveled edges.



PROPER USES. Sledges are designed for general sledging operations in striking wood, metal, concrete, or stone. Common uses are drifting heavy timbers and striking spikes, cold chisels, rock drills, and hardened nails.

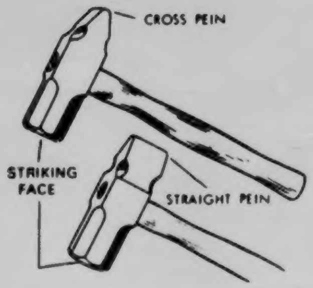
ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

ABUSE/ MISUSE. NEVER use a sledge to strike a hammer, sledge, or maul. NEVER use a sledge with a loose or damaged handle.

WHEN TO REPLACE. Discard any sledge if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

BLACKSMITHS' HAND HAMMERS AND SLEDGES--STRAIGHT AND CROSS PEIN

DESCRIPTION. These heavy-duty hammers are designed for the use of blacksmiths in striking metal. The striking face is crowned with a beveled edge.

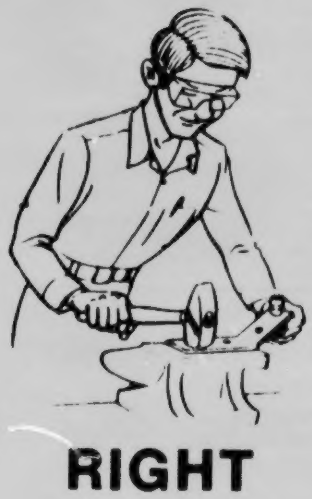


PROPER USES. The striking face is designed for general blacksmith work in striking unhardened metal. The peins are used for shaping (fullering) and bending unhardened metal.

ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

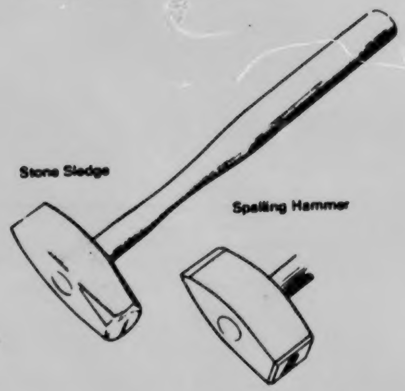
ABUSE/MISUSE. NEVER use a sledge to strike a hammer, sledge, or maul. NEVER use a sledge with a loose or damaged handle.



RIGHT

WHEN TO REPLACE. Discard any sledge if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

STONE SLEDGES AND SPALLING HAMMERS

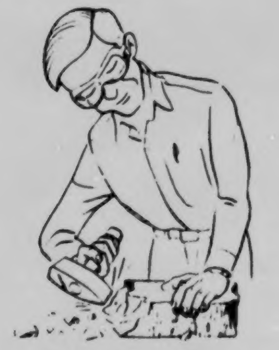


DESCRIPTION. These are stone masons' tools and are made in slightly varying configurations by different manufacturers. The sledge usually has a crowned, oval striking face with a napping face opposite. The spalling hammer has a beveled striking face.

PROPER USES. Sledges are designed for breaking up stone and concrete. The spalling hammers are designed for cutting and shaping stone and concrete.

ALWAYS WEAR SAFETY GOGGLES TO

PROTECT THE EYES

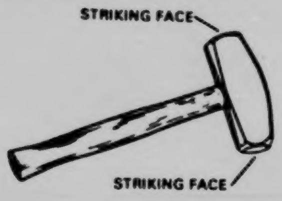


RIGHT

ABUSE/MISUSE. NEVER use these tools for striking metal. NEVER use a tool with a loose or damaged handle.

WHEN TO REPLACE. Discard any sledge if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

HAND DRILLING OR MASH HAMMERS

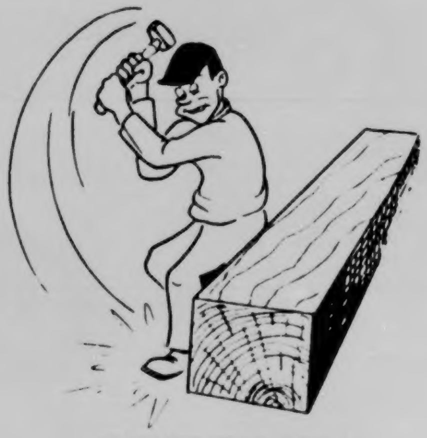


DESCRIPTION. These heavy, short-handled hammers are made in slightly varying configurations by different manufacturers. The double-faced head has crowned and beveled striking faces.

PROPER USES. These hammers are designed for use with chisels, punches, star drills, and hardened nails. Their design permits heavy blows with limited swing--especially advantageous in restricted working areas.

ALWAYS WEAR SAFETY GOGGLES
TO PROTECT THE EYES

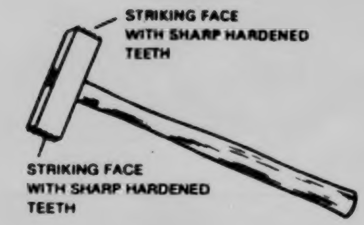
ABUSE/MISUSE. NEVER use these tools for sledging or stone work. Avoid glancing blows against other hardened surfaces. NEVER use a hammer with a loose or damaged handle.



WRONG

WHEN TO REPLACE. Discard any hammer if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle.

BUSH HAMMERS


STRIKING FACE WITH SHARP HARDENED TEETH
STRIKING FACE WITH SHARP HARDENED TEETH

DESCRIPTION. This is a double striking face tool of compact, rectangular design having both striking faces with sharp, hardened teeth.

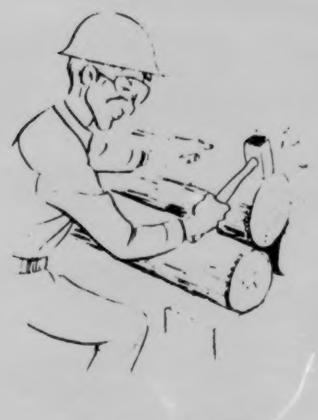
PROPER USES. Bush hammers are designed for a single purpose--roughing and chipping concrete.

ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

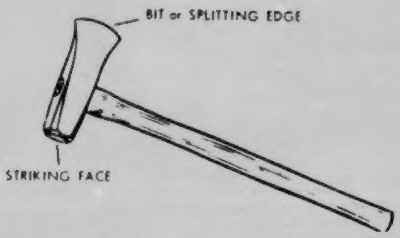
ABUSE/MISUSE NEVER use this tool for striking anything but concrete. NEVER use a hammer with a loose or damaged handle.

WHEN TO REPLACE. Discard the tool if the teeth are dull and/or flattened. If only the handle is damaged, replace it with an equivalent new handle.



RIGHT

WOODCHOPPERS' MAULS

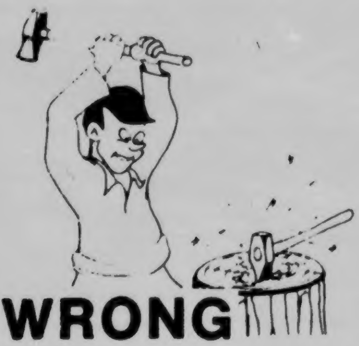

BIT or SPLITTING EDGE
STRIKING FACE

DESCRIPTION. Woodchoppers' mauls have a round, bevel-edged striking face with a splitting edge opposite.

PROPER USES. These tools are designed for splitting wood. They are also used in conjunction with wood-splitting wedges by first making a notch with the splitting edge and then driving the wedge with the maul's striking face.

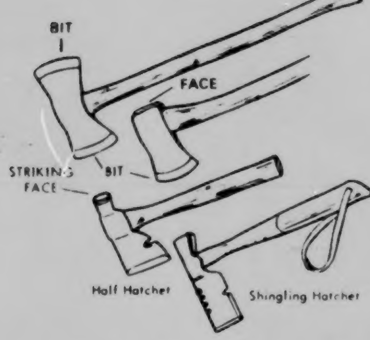
ALWAYS WEAR SAFETY GOGGLES
TO PROTECT THE EYES

ABUSE/MISUSE. NEVER use this tool in striking concrete. NEVER drive one maul by striking with another maul, sledge, or other striking tool. NEVER use a maul with a loose or damaged handle.



WHEN TO REPLACE. Discard any maul if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle. Redress the bit as instructed in the "Redressing Instructions" unit.

Axes and Hatchets



Description. Axes are made in various patterns and head configurations. The more widely-used types are illustrated.

Hatchets are made in an even greater variety of patterns, since specific types are intended for use by various tradesmen (carpenters, roofers, dry wall installers, rig builders, etc.). Handles may be wood, tubular or solid steel, or fiberglass. Tubular steel, solid steel, and fiberglass handles are generally furnished with rubber-type grips.

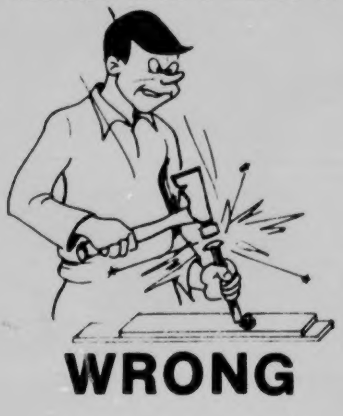
Proper Uses. The double-bit axe is usually used to fell, trim, or prune trees and to split and cut wood. It is also used for notching and shaping logs and timbers. The single bit axe, in addition to the above uses, is used to drive wood stakes with the face.

Hatchets are used for cutting, splitting, trimming and hewing, and driving unhardened nails and stakes with the striking face.

Abuse/Misuse. The cutting edges of axes and hatchets are designed for cutting wood and equally soft materials. They should never be struck against metal, stone, or concrete. The striking faces of hatchets are properly hardened for driving common nails but should never be used to strike chisels, punches, rock drills, or other hardened metal tools, or for striking stone or concrete. **Never** use an axe as a wedge or a maul. **Never** use an axe or hatchet with a loose or damaged handle.

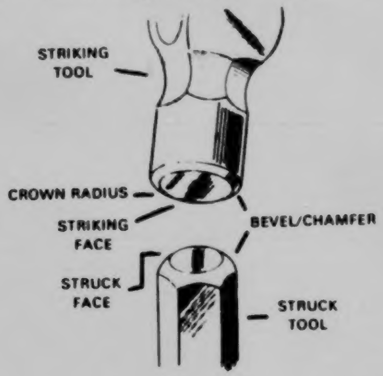
ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

When to Replace. Discard any axe or hatchet if it shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle. Cutting edges may be redressed if done properly.



STRUCK OR HAMMERED TOOLS

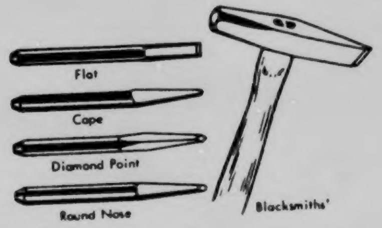
This unit deals with the use-related tools that are struck with the tools described in the "Striking Tool" unit.



A knowledge of the basics of good tool design will be helpful. The striking and struck faces of tools are designed to direct the force of blows toward the center or body of the tool. Blows struck off center are not directed toward the body of the tool where they can be absorbed, but rather travel directly along the sides of the tool where there is insufficient back-up material. The net effect is shearing rather than cushioning, which is dangerous.

The angle and thickness of the cutting edges of tools are designed to give maximum cut and durability. When the cutting edge becomes dull, not only does the cutting ability decrease, but the durability is drastically reduced. Many failures are caused by dullness.

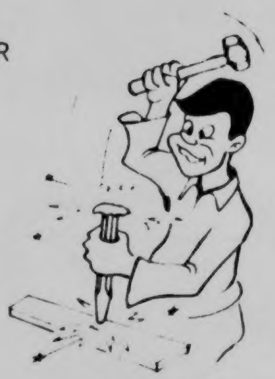
COLD CHISELS



DESCRIPTION. With the exception of the blacksmiths' pattern, cold chisels may be made from round, square, hexagon, or octagon steel stock. The blacksmiths' cold chisel is fitted with a handle.

PROPER USES. Cold chisels have a cutting edge at one end for cutting, shaping, and removing metals such as: cast iron, wrought iron, steel, bronze, copper, etc. that are softer than the cutting edge itself. They also have a struck face on the opposite end.

ABUSE/MISUSE. NEVER use cold chisels for cutting or splitting stone or concrete. NEVER use a dull chisel or one with a mushroomed head. NEVER use a blacksmiths' cold chisel with a loose or damaged handle.



WRONG

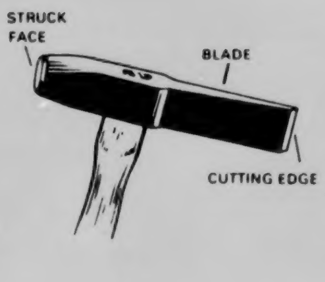
ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

WHEN TO REPLACE. Discard any chisel if it is bent or shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle. If the cutting edge is dull, it may be redressed.

HOT CHISELS

DESCRIPTION. Hot chisels or hot cutters are very similar to blacksmiths' cold chisels except that the cutting edge or bit is wider and the blade is thinner.

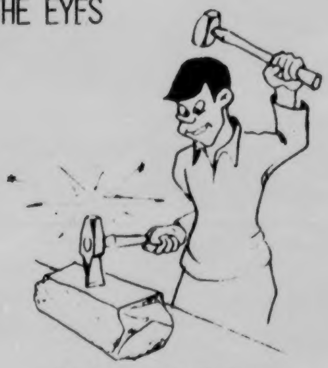


PROPER USES. Hot chisels are designed for cutting hot steel.

ABUSE/MISUSE. NEVER use hot chisels for cutting cold metal, stone, or concrete. NEVER use a dull chisel or one with a mushroomed head. NEVER use a chisel with a loose or damaged handle.

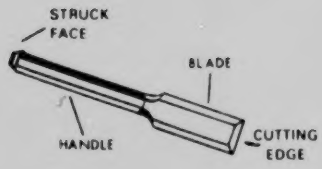
ALWAYS WEAR SAFETY GOGGLES TO PROTECT THE EYES

WHEN TO REPLACE. Discard any chisel if it is bent or shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle. If the cutting edge is dull, it may be redressed.



WRONG

ALL-STEEL WOOD AND RIPPING CHISELS



DESCRIPTION. This type of wood chisel is made from a single piece of steel, comprising the blade, handle, and struck face.

PROPER USES. These are heavy-duty wood cutting tools designed for rough work.

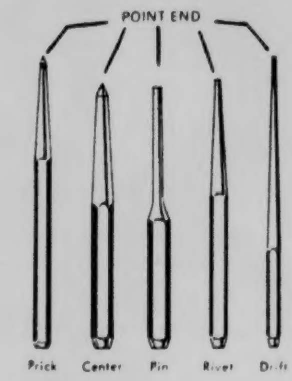
ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

ABUSE/MISUSE. NEVER use an all-steel chisel with a mushroomed struck face or a chipped or dull cutting edge. NEVER use it on metal.

WHEN TO REPLACE. Discard any chisel if it is bent or shows dents, cracks, chips, mushrooming, or excessive wear. If only the handle is damaged, replace it with an equivalent new handle. If the cutting edge is dull, it may be redressed.

HAND PUNCHES

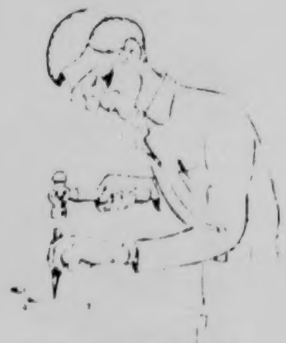


DESCRIPTION. Hand punches are made from square, round, hexagon, or octagon steel stock in the various illustrated patterns.

PROPER USES. Punches are designed to mark metal and other materials softer than the point end, to drive and remove pins and rivets, and to align holes in the different sections of material.

ABUSE/MISUSE. NEVER use a punch with a mushroomed struck face or with a dull, chipped or deformed point.

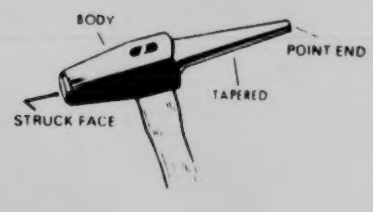
WHEN TO REPLACE. Discard any punch if it is bent or shows dents, cracks, chips, mushrooming, or excessive wear. If the point is dull or deformed, it may be redressed.



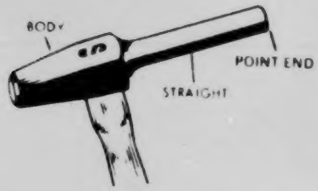
RIGHT

BLACKSMITHS' PUNCHES

ROUND



BACKING OUT



DESCRIPTION. Blacksmiths' round and backing-out punches are made from a solid piece of steel. The punch end of the round punch is tapered from point to body, whereas the punch end of the backing-out punch is the same diameter from point to body. Both types are fitted with handles.

PROPER USES. Blacksmiths' round punches are designed for drifting holes, aligning, and driving pins. Blacksmiths' backing-out punches are designed for backing out bolts, rivets, and pins.

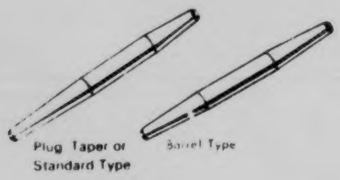
ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

ABUSE/MISUSE. NEVER use a punch with a mushroomed struck face or a chipped or deformed point. NEVER use a punch with a loose or damaged handle.

WHEN TO REPLACE. Discard any punch if it is bent or shows dents, cracks, chips, mushrooming, or excessive wear. If the point end is deformed, it may be redressed. If only the handle is damaged, replace it with an equivalent new handle.

DRIFT PINS

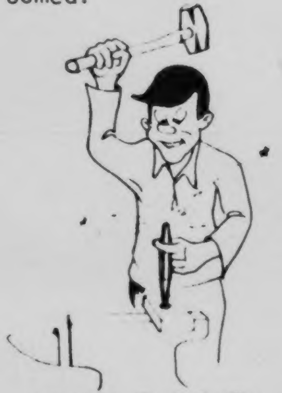


DESCRIPTION. Drift pins are made from round steel stock. The plug or standard type has an abrupt taper at one end, and a longer taper at the other end. The barrel type has equal tapers at both ends.

PROPER USES. Drift pins are designed for aligning holes in metal.

ABUSE/MISUSE. NEVER use a drift pin as a punch. NEVER strike a drift pin if either end is chipped or mushroomed.

WHEN TO REPLACE. Discard any drift pin if it is bent or if either end shows dents, cracks, chips, mushrooming, or excessive wear. Deformed points may be redressed.

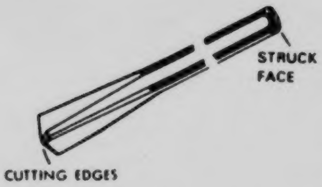


WRONG

ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

STAR DRILLS

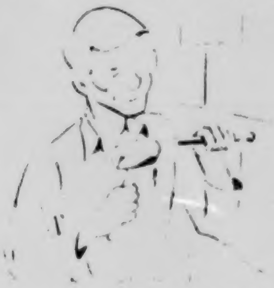


DESCRIPTION. The cutting end of a star drill resembles four chisels joined at their cutting edges to form a cross.

PROPER USES. Star drills are designed for drilling holes in masonry (stone, concrete, brick, etc.) They should be struck squarely with a hand drilling hammer or sledge, and the drill should be rotated after each blow.

ABUSE/MISUSE. NEVER use a star drill on anything but masonry. NEVER use a star drill with a dull cutting edge or with a chipped, battered, or mushroomed struck face.

WHEN TO REPLACE. Discard any star drill if it is bent or shows dents, cracks, chips, mushrooming, or excessive wear. If the cutting edges are dull, they may be redressed.

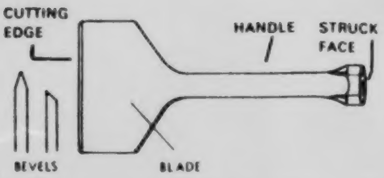


RIGHT

ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

Brick Chisels and Brick Sets

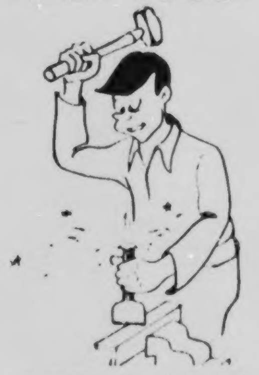


Description. These types of chisels and sets are made from a single piece of steel comprising blade, handle, and struck face. The chisel has a double bevel; (the set has a single bevel) form the cutting edge.

Proper Uses. These chisels and sets are designed for scoring and cutting, adjusting, and trimming bricks or blocks. They should be struck with a hand drilling hammer or sledge--not a bricklayers' hammer.

ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

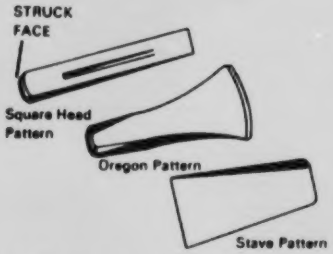


WRONG

Abuse/Misuse. **Never** use these tools on metal--they are strictly masonry tools. **Never** use a chisel or set with a dull cutting edge or with chipped, battered, or mushroomed struck face.

When to Replace. Discard any chisel or set if it is bent or shows dents, cracks, chips, mushrooming, or excessive wear. Dull cutting edges may be redressed.

Wood Splitting Wedges

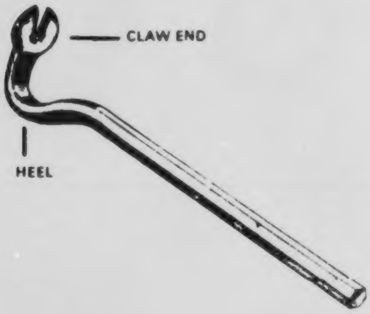


Description. Wood splitting wedges are usually made from a solid piece of steel. They are made in various patterns; the ones illustrated are the most commonly used

Proper Uses. Wood splitting wedges are designed for splitting logs, firewood, staves, and other wood products. Always use a woodchoppers' maul or an axe to make a starting notch. Wedges should be struck with a sledge or woodchoppers' maul having a larger striking face than the struck face of the wedge.

Abuse/Misuse. **Never** use a wedge with a mushroomed or chipped struck face.

When to Replace. Discard any wedge if it shows dents, cracks, chips, mushrooming, or excessive wear. If the splitting edge is dull, it may be redressed.



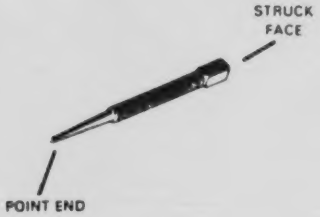
NAIL PULLER BARS

DESCRIPTION. Nail puller bars are made from bar steel stock. The claw ends are formed at an angle to pull nails.

PROPER USES. The nail puller bar is designed for extracting deeply imbedded nails. The claw is driven into the wood under the nail head by striking the heel of the claw with a heavy hammer, such as a hand drilling hammer or sledge. The nail is then extracted at an angle by pulling the bar in the direction of the user.

ABUSE/MISUSE. NEVER use a nail hammer to strike a nail puller bar. The striking face is too small and may chip.

WHEN TO REPLACE. Discard any bar that is bent or has a chipped or broken claw or a rounded or dull bevel.



NAIL SETS

DESCRIPTION. Nail sets are made from bar steel stock and have a cupped point end opposite the struck face.

PROPER USES. Nail sets are used to drive nail heads below a wood surface.

ABUSE/MISUSE. NEVER use a nail set for punching holes in metal, marking metal, aligning holes, or driving pins or rivets.

WHEN TO REPLACE. Discard any bar that is bent or shows dents, cracks, chips, mushrooming, or excessive wear. Discard--do not redress.

ALWAYS WEAR SAFETY GOGGLES

TO PROTECT THE EYES

REDRESSING INSTRUCTIONS

The redressing and reshaping of tools having chipped, battered, or mushroomed striking or struck surfaces is not recommended. When a tool has reached this stage, through normal use or abuse, it should be discarded.

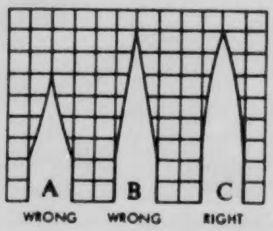
There are three basic rules which apply to the redressing of dull cutting edges:

1. Rigidly support the tool being redressed.
2. File or stone away from the cutting edge.
3. The original contour of the cutting edge should be restored.

ALWAYS WEAR SAFETY GOGGLES
TO PROTECT THE EYES

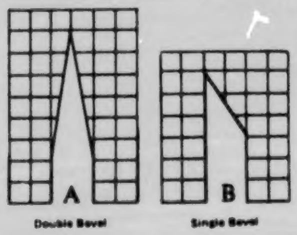
Axes.

Use a hand file for redressing. Start two or three inches from the cutting edge and file to about 1/2 inch from the edge. Work for a fan shape, leaving reinforcement at the corners for strength. File the remaining 1/2 inch, blending it into the previously filed area and preserving the original contour of the cutting edge. Remove all scratches with a whetstone or hone 1/2 inch back from the cutting edge. See cross section C of the illustration below for the "right" way to shape the edge in redressing axes. Other illustrations show "wrong" ways to redress axes.



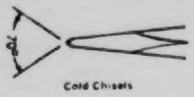
HATCHETS

Hatchets with double bevels should be redressed as illustrated in A below. Hatchets with a single bevel should be redressed as illustrated in B below. Use a hand file for redressing. Remove scratches with a whetstone.


A
B
Double Bevel
Single Bevel

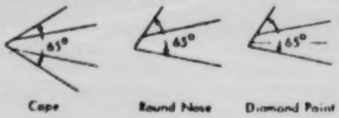
COLD CHISELS (FLAT)

Cold chisels are hardened on the cutting edge. Redressing may be done with a hand file or whetstone restoring it to the original shape or to an included angle of approximately 70 degrees (see illustration).


Cold Chisels

OTHER MACHINISTS' CHISELS

Other commonly used metal-working chisels are round nose, diamond point, and cape. Redressing instructions are the same as for flat cold chisels, except that the bevel angles are approximately as illustrated.


65°
65°
65°
Cape
Round Nose
Diamond Point

HOT CHISELS

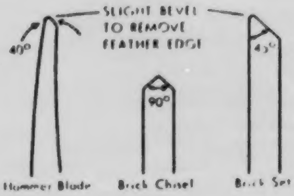
These are handled tools used for cutting hot metal. Redressing instructions are the same as for cold chisels.

PUNCHES

The working ends of pin and rivet punches and blacksmiths' punches should be redressed flat and square with the axis of the tool. The points of center punches should be redressed flat and square with the axis of the tool. The points of center punches should be redressed to an included angle of approximately 60 degrees; prick punches, to an included angle of approximately 30 degrees.

BRICKLAYERS' TOOLS

Bricklayers' tools should be redressed to approximately the angles illustrated.


SLIGHT BEVEL TO REMOVE FEATHER EDGE
40°
90°
45°
Hammer Blade
Brick Chisel
Brick Set

WOODCHOPPERS' MAULS AND WOOD SPLITTING WEDGES

The instructions for redressing axes apply also to these tools although they have heavier heads and thicker sections in the bit. Hand file the splitting edge to an included angle of approximately 70-degrees. See the cold chisel illustration for the 70-degree included angle.

STAR DRILLS

Hand file all cutting edges to an included angle of approximately 70 degrees. See the cold chisel illustration for the included angle of 70 degrees.

PROSPECTING PICKS

Redress with a hand file to restore the original contour of the pick end.

SCREWDRIVERS

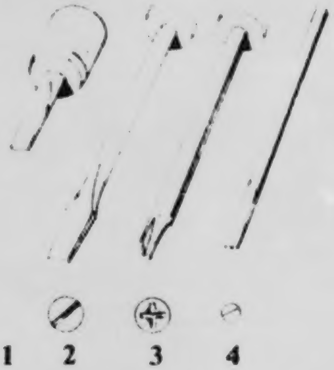
Next to the hammer, the screwdriver is probably the most abused tool in the homeowner's or mechanic's tool kit. Screwdrivers are available in a wide variety of shapes, sizes, and materials. However, they are all intended for one simple use: driving and withdrawing fasteners such as wood screws, machine screws, and self-tapping screws. Unfortunately, the screwdriver is used for prying, chiseling, scraping, scoring --and only sometimes for its intended use of driving screws!

The most common abuse is using a screwdriver that doesn't match or fit the screw. A person wouldn't wear a pair of shoes that are too small or too big for the feet--this would be abusing the feet. For the same reason, one should not use a screwdriver that is too small or too big for the screw it is to drive. Use the right screwdriver and thus avoid chewing up the screw head, damaging the screwdriver, or barking the knuckles.

The abuse of a screwdriver and the screw is most often due to the fact that the homeowner or mechanic simply does not have a proper assortment of screwdrivers on hand.

Bear the following points in mind when using a screwdriver: Always match the size of the screwdriver to the JOB; and always match the type of screwdriver to the HEAD of the screw. After all, one wouldn't want to drive a large No. 12 screw with a small 3/32 or 3/16 inch screwdriver and neither would one drive a Phillips screw or other recessed screw with a conventional screwdriver.

Be careful not to confuse a Phillips screwdriver with a Reed & Prince screwdriver. They are not interchangeable. See page 1474 for the differences.

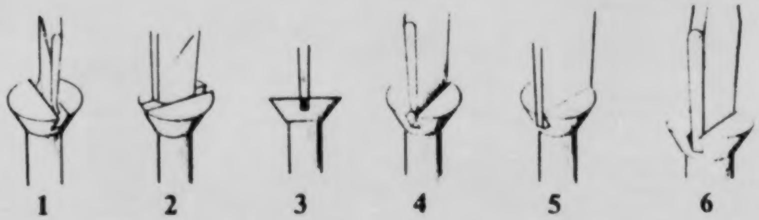


Typical Screwdrivers

1. Stubby screwdriver for working in close quarters.
2. Screwdriver with a square shank to which a wrench can be applied to remove stubborn screws.
3. Screwdriver for Phillips screws
4. Cabinet screwdriver with a thin shank to reach and drive screws in deep, counterbored holes.

Basic Safety Rules that Apply to the Use of a Screwdriver

1. Make sure that the tip fits the slot of the screw; it should not be too loose or too tight.
2. Do not use a screwdriver as a cold chisel or punch.
3. Do not use a screwdriver (or any other tool) near live wires.
4. Do not expose a screwdriver to excessive heat.
5. Redress a worn tip with a file in order to regain a good straight edge.
6. Discard a screwdriver that has a worn or broken handle.



1 This tip is too narrow for the screw slot. It will bend or break under pressure.

2. A rounded or worn tip. Such a tip will ride out of the slot as pressure is applied.

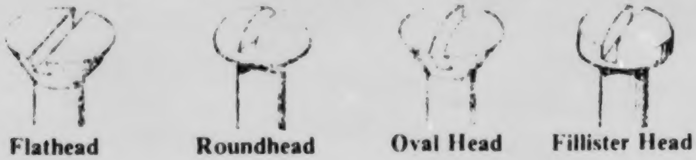
3. This tip is too thick. It will only serve to chew up the slot of the screw.

4. A chisel ground tip will also ride out of the screw slot. Best to discard it.

5. This tip fits, but is too wide and will tear the wood as the screw is driven home.

6. The right tip. This tip is a snug fit in the slot and does not project beyond the screw head.

COMMON SLOTTED HEAD SCREWS

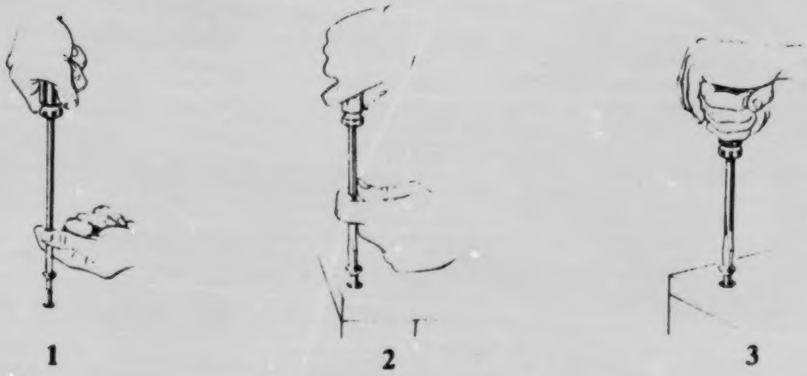


Driving the Screw

Always make a pilot hole before driving a screw. This is especially important when driving a screw into hardwood, or when the screw is near the edge of a board. Pilot holes can be made in softwoods, and in some hardwoods, with an awl--if the screws to be used are small. However, if driving No. 6 and larger screws, it is best to DRILL a pilot hole or use a threaded screw hole starter. Pilot holes should always be made if the screws are to be driven into dense hardwoods.

If the screw is a flathead, the pilot hole should also be countersunk so the head of the screw will be flush with the work when it is driven home.

THE RIGHT WAY TO DRIVE A SCREW



1. Insert the tip of the screw in the pilot hole. Insert the screwdriver tip in the slot of the screw. Hold the tip steady with one hand and make sure the shank of the screwdriver is perpendicular to the head of the screw and in line with the shank of the screw.

2. Use the left hand(if right-handed) to keep the blade steady as the handle of the screwdriver is turned.

3. After the screw is almost in, it is safe to use both hands (as shown) for extra turning power to seat the screw. Note the position of the left hand (if the user is right-handed). This will allow additional downward pressure to be applied, thus making certain that the driver tip is firmly seated in the screw slot. If the screw is a flathead make sure that the pilot hole has a countersunk recess at the top and the screwdriver tip is narrow enough to avoid touching wood.

The job of driving the screw can be eased considerably if the threads are given an application of wax. Wax is preferable to soap, because soap has a tendency to rust the screw threads (making possible future withdrawal difficult).

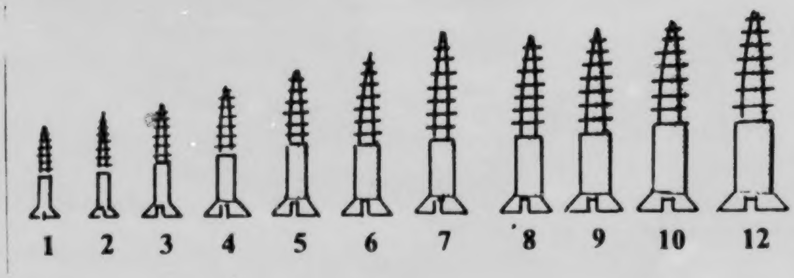
Unless some sort of a pilot hole has been drilled, a screw will tend to follow the grain of the wood. So, having drilled or made a pilot hole, hold the screw as indicated on the preceding page, with the screwdriver tip firmly engaged in the slot. Turn the screwdriver gently to engage the first one or two threads of the screw and MAKE SURE THAT THE SCREW IS BEING DRIVEN STRAIGHT. After the screw has been started, and it is certain that it will be driven straight, remove the fingers from the screw and apply all talent and attention to the screwdriver. The screw should now be absolutely perpendicular to the surface of the work (unless the screw is to be driven at an angle) with the screwdriver held in line with the screw.

It is much easier to drive a screw straight if the handle of the screwdriver is large enough to maintain the necessary torque for the size of the screw to be used.

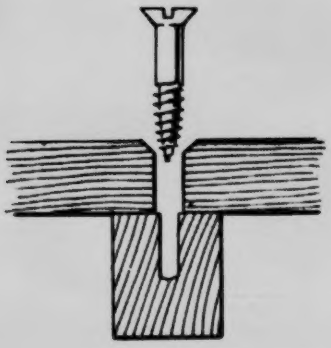
A good quality blade, properly hardened, is a must--especially when driving large diameter screws into tough woods.

CLEARANCE HOLES

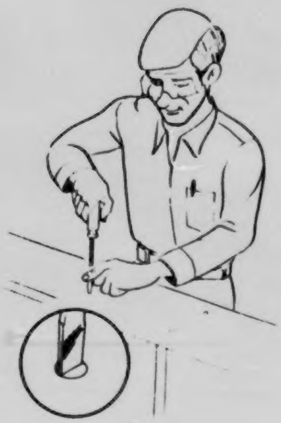
Sometimes a clearance hole, in addition to a pilot hole, should be drilled in order to do a workmanlike job. For example, when fastening a metal bracket to wood, or when screwing two pieces of wood together, a clearance hole equal to the diameter of the screw body or shank is necessary. Without the clearance hole, the body of the threads of the screw will hang up on the metal or the leading piece of wood, preventing them from being drawn together tightly.



Screws are available in many lengths. However, the number by which a screw is designated, such as a No. 10, always refers to its shank diameter. This drawing shows actual size screws and their corresponding number.



A clearance hole is necessary when screwing two pieces of wood together.



RIGHT

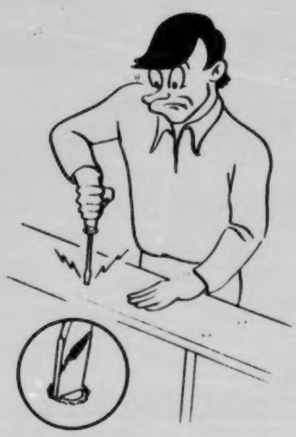
Cal is using the right technique in driving this screw home. The blade of the screwdriver is a snug fit in the slot of the screw and does not quite project to the edge.

SCREWDRIVERS FOR SLOTTED-STYLE SCREWS

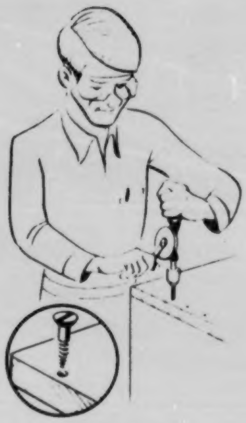
Now that a little bit has been learned about how to use a screwdriver, consider the various kinds of screwdrivers that are available and the right and wrong way to use--and abuse--these screwdrivers.

The so-called standard, or conventional screwdriver, is used for screws with slotted. heads. These screwdrivers are usually classified according to tip width and blade length. Generally, the longer the length, the wider the tip. This is not always true as some rather long screwdrivers may have a narrow tip. Cabinet style screwdrivers, which have long shanks and narrow tips, are useful for driving screws into recessed and counterbored openings in fine furniture and cabinets. On the other hand, there are short, stubby screwdrivers with rather wide tips for driving screws in confined quarters. The great assortment of screwdrivers available today means that one can buy a screwdriver in practically any length and in tip size desired.

Most screwdriver tips are tapered. The tip thickness determines the size of the screw that the screwdriver will drive without damaging the screw slot. The taper permits the screwdriver to drive more than one size of screw.



WRONG



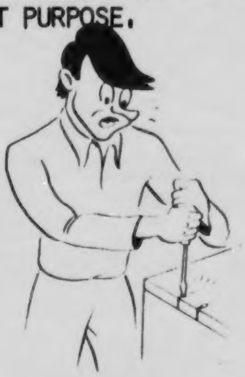
RIGHT

Don't use a screwdriver whose tip extends beyond the length of the slot in the screw. Too wide a tip will chew up the wood as the screw is being driven home.

Careful Cal knows enough to drill pilot and clearance holes when driving screws that are near the edge of a board. A little wax on the threads will ease the job.

Heavy-duty screwdrivers are available with square shanks so that a wrench can be used on the shank for extra turning power. NEVER use pliers on a screwdriver shank when the going gets tough. This will cause a chewing up of the shank. What to do in such a case? Use the largest possible screwdriver that will fit the slot of the screw. As a rule, the bigger the screwdriver the larger the diameter of the handle, and the larger the diameter of the handle the greater the torque, or turning power. If absolutely necessary, use a wrench on the shank to apply the extra power (torque) needed. However, use a wrench only on a screwdriver with a square shank ESPECIALLY DESIGNED FOR THAT PURPOSE.

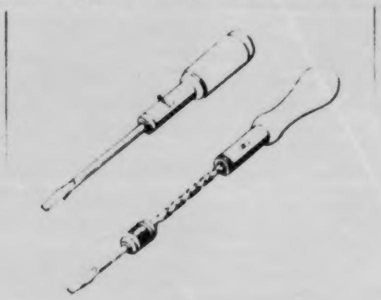
Harry will always split the wood if he drives a screw too close to the end of the work without first drilling a pilot and clearance hole.



WRONG

RATCHET SCREWDRIVERS

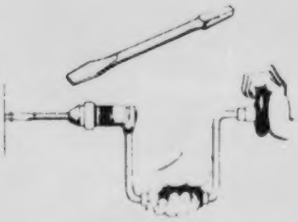
One type of rapid-action screwdriver is the spiral ratchet screwdriver. This screwdriver has a spring-loaded mechanism in the handle. Pushing down on the handle causes the bit of the screwdriver to turn rapidly, thus driving the screw in a shorter time than could be accomplished with the use of a conventional screwdriver. Letting up on the handle allows the operator to continue the action. These screwdrivers come in several styles. Some have the mechanism as part of the handle; others have it as part of the shank. In either case, a small lever is set so that even though the operator moves the handle back and forth--or up and down--the bit of the screwdriver moves in only one direction--to drive the screw. The lever can also be set so that the ratchet action removes the screw. It also can be set so that the screwdriver can be used as a conventional screwdriver, with no ratchet action.



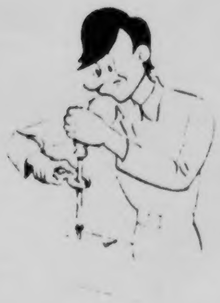
Two types of rachet screwdrivers. The one at the top has the rachet mechanism in the handle. The lower screwdriver operates with a spiral action.

WHEN USING ANY SPIRAL RATCHET SCREWDRIVER, IT IS BEST TO PUSH DOWN FIRMLY AND SLOWLY UNTIL THE SCREW IS PROPERLY STARTED. OTHERWISE, IT IS POSSIBLE TO FIND THAT THE BIT HAS SLIPPED OUT OF THE SLOT. THESE SCREWDRIVERS SHOULD BE STORED ONLY IN THE EXTENDED POSITION TO PREVENT THE POSSIBILITY OF A SUDDEN UNEXPECTED RELEASE BY SOMEONE UNFAMILIAR WITH THE TOOL.

LARGE SCREWS in tough wood can be easily driven by using special bits that fit into a carpenter's brace. Because tremendous turning power is generated by the brace, make sure there is a proper pilot hole, as it is quite easy to shear off the head or even to twist the screw in half if too much pressure is applied to a balky screw. Needless to say, it is always best to drill a pilot hole when driving large screws with a carpenter's brace.

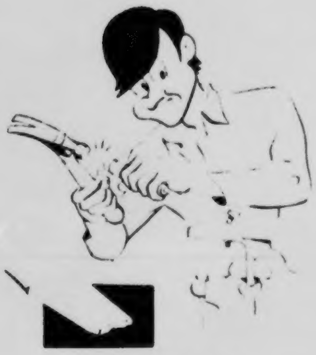


Special screwdriver bit that can be chucked into a carpenter's brace.



WRONG

Hazardous Harry strikes out again. Please, Harry, don't use pliers on the shank of a screwdriver in order to remove a stubborn screw.

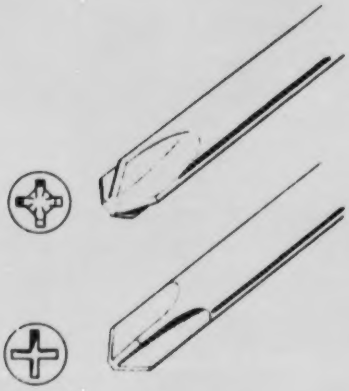


WRONG

NEVER, NEVER use a screwdriver as a cold chisel. Just look what Hazardous Harry has done to the tip of a perfectly good screwdriver. In addition, the hero is not even wearing safety goggles.

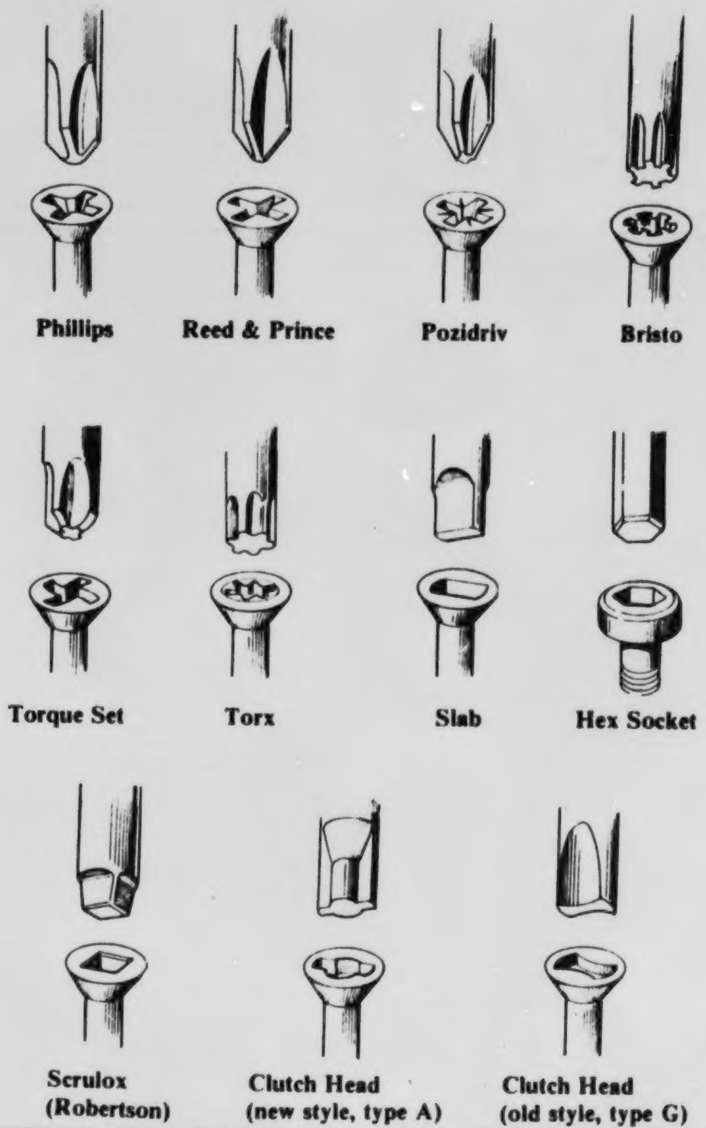
SCREWDRIVERS FOR SCREWS WITH RECESSED OPENINGS

The most common screw with a recessed "slot" is the Phillips screw. These screws have what appears to be two slots at right angles to each other. However, a conventional screwdriver should never be used to drive a Phillips screw or any other type of screw with a specialized opening. Such screws are shown on the following page. ALWAYS use the screwdriver that is especially designed to drive these fasteners.



The Reed & Prince screw head and its matching screwdriver (bottom) somewhat resembles the Phillips type (top), but there is a difference. The slots in a Phillips screw end in a slight curve at their intersection, unlike the Reed & Prince screw whose slots meet at an exact right angle.

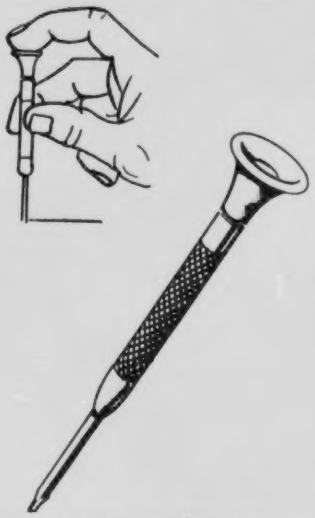
RECESSED SCREWS AND SCREWDRIVERS


Phillips
Reed & Prince
Pozidriv
Bristo
Torque Set
Torx
Slab
Hex Socket
Scrulox (Robertson)
Clutch Head (new style, type A)
Clutch Head (old style, type G)

SPECIALTY SCREWDRIVERS

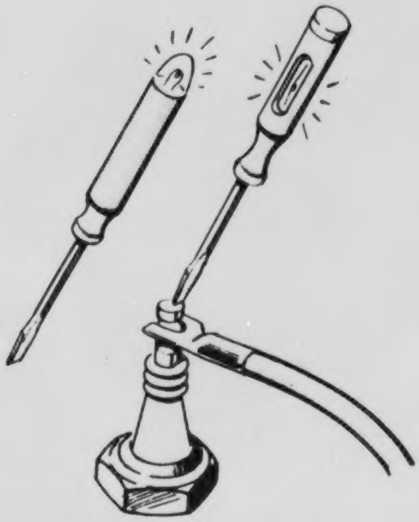
In addition to the types of screws and screwdrivers described so far, there are many screwdrivers whose use is quite specialized. Some of these are:

JEWELERS'S SCREWDRIVERS. These are distinguished by a rotating head which is held by the forefinger to steady the screwdriver while the thumb and middle finger turn the screwdriver to remove or install the small screws used by jewelers, model railroad fans, and persons who work with tiny parts and screws.



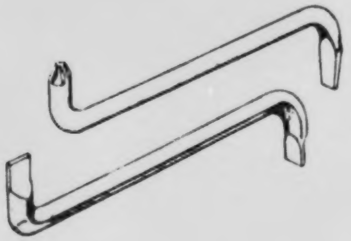
A jeweler's screwdriver, used with tiny screws, is steadied by placing the forefinger on the free-turning knob.

IGNITION TESTING SCREWDRIVERS. These screwdrivers have a small neon bulb installed in the handle which glows when the shank of the screwdriver comes near the top of an operating spark plug. No glow means that that particular plug is not firing. They are used by automobile mechanics.

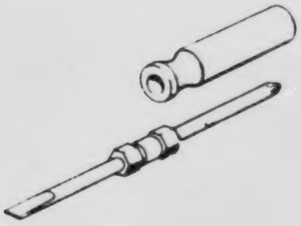


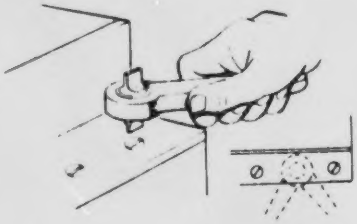
An ignition testing screwdriver, used by auto mechanics, shows which spark plug is not firing or is misfiring.

OFFSET SCREWDRIVERS. These screwdrivers are designed for removing and inserting screws in places where it is impossible to use a straight shank screwdriver. They are available in many combinations: a narrow tip on one side and a wide tip on the other side; a Phillips tip on one side and a conventional tip on the other side; with two Phillips tips (one large and one small); or with the same size tips at each end, but with one tip at right angles to the handle while the other tips is paralled to the handle (this arrangement makes the screwdriver extremely handy when the turning area is limited).

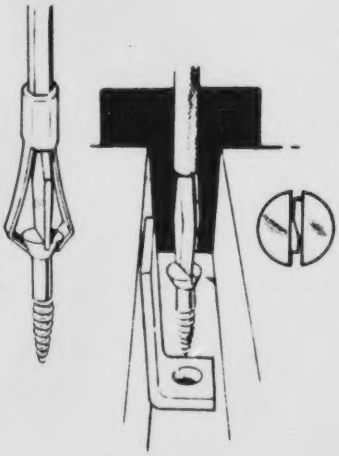


Offset screwdrivers for driving screws in awkward places. Below, a reversible screwdriver with a double-ended bit.





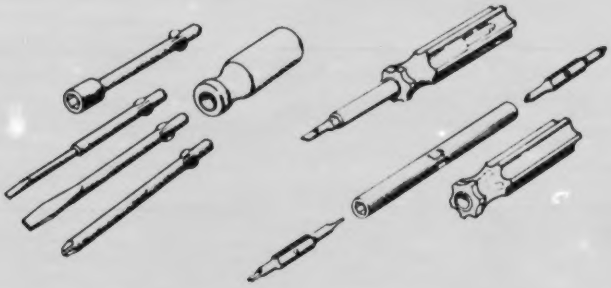
A ratchet-type offset screwdriver for working in tight spots; it is reversible.



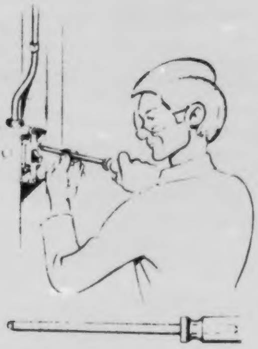
The screw-holding screwdriver is a must for working in close quarters, as shown. The type shown at the left uses clips to hold the screw. The one at the right has a sliding collar that spreads the split blade of the screwdriver to hold the screw. After the screw has been firmly started, further driving can be done with a conventional screwdriver.

INTERCHANGEABLE BLADE SCREWDRIVERS. The hollow handle of this type of screwdriver will accept a number of different type blades. Sometimes the blades are double-ended with a narrow tip on one end and a wider tip on the other end. Combinations of Phillips, conventional, clutch head, scrulox, and hex head are available.

INSULATED SCREWDRIVERS. These are used by electricians and maintenance workers. As their name implies, the shank as well as the handle is completely insulated with a dielectric material, with only the tip exposed. This type of screwdriver minimizes the possibility of "shorts" when making connections in tight quarters under "live" conditions. Incidentally, they should only be used under such conditions by licensed electricians and repairmen who are aware of the risks involved.

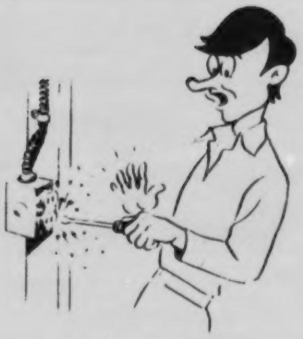


Two types of screwdrivers that use interchangeable bits. The one at the left has a hollow handle that will accept any one of the four bits shown. The screwdriver at the right has two double-ended bits held in each end of a tube. The tube is reversible in the handle and the bits are reversible in the tube.



RIGHT

Careful Cal is using an insulated screwdriver. Handle and shank are covered with an insulated material; only the extreme end of the top is exposed. These screwdrivers minimize the possibility of shock or causing a short circuit when working on electrical equipment. It is best to turn off the current when doing this kind of work.



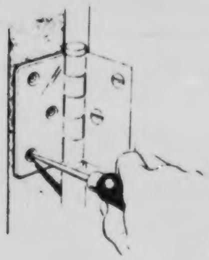
WRONG

As usual, Hazardous Harry is wrong again. But this time he's wrong on two counts. First of all, he never bothered to turn off the current before starting to work on that outlet. Secondly, he doesn't seem to know enough to use an insulated screwdriver when doing such work.

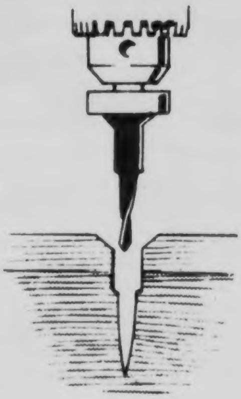
NON-SPARKING SCREWDRIVERS. Found chiefly on yachts and boats, these screwdrivers are made out of an alloy (usually beryllium copper) that will not emit a spark if accidentally struck against metal. They minimize the risk of explosion when used under hazardous conditions, such as when working in the hold of a ship that may be filled with gasoline fumes.

THE AWL. A handy accessory to a screwdriver set is an awl. With it, one can make a starting hole for a screw in soft wood.

Force the awl into the wood with a twisting motion. The hole need not be as deep as the length of the screw. With large screws--and especially when working with hard wood--it is always advisable to first drill a pilot hole before attempting to drive the screw.



An awl can be used to make a starting hole for small screws in soft wood.



This device drills a pilot hole, a clearance hole, and a countersunk recess for flathead screws--all in one operation.

DO'S AND DON'TS WHEN USING SCREWDRIVERS

1. Don't hold the work in one hand while using the screwdriver with the other. If the screwdriver slips out of the slot the worker will be most likely to receive a gash on the hand.
2. Don't use a screwdriver with rounded edges or tips; it will slip and cause damage to the work or the worker.
3. A rounded tip should be redressed with a file; make sure the edges are straight.
4. Don't use a screwdriver near a live wire or for electrical testing.
5. Don't use a screwdriver to check a storage battery or to determine if an electrical circuit is live.
6. Don't use a screwdriver for prying, punching, chiseling, scoring, or scraping.
7. Use a screw-holding screwdriver to get screws started in awkward, hard-to-reach areas.
8. Use an offset screwdriver in close quarters where a conventional screwdriver cannot be used.
9. Use a ratchet-type screwdriver for speed and comfort when a great number of screws are to be driven.
10. Don't use pliers on the handle of a screwdriver to get extra turning power. A wrench should be used only on the square shank or bolster of a screwdriver that is especially designed for that purpose.
11. Don't expose a screwdriver blade to excessive heat as it may reduce the hardness of the blade.
12. Don't use a screwdriver for stirring paint.
13. Don't use a screwdriver with a split or broken handle.
14. Screwdrivers used in the shop are best stored in a rack. This makes it possible to quickly select the right screwdriver.
15. Keep the screwdriver handle clean; a greasy handle is apt to cause an accident.

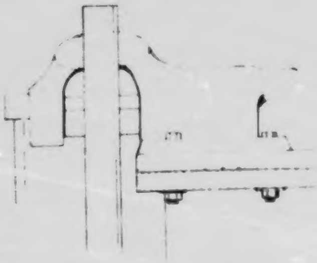
VISES

The vise, sometimes called the third hand (but no hand can grasp work as firmly as a vise), is the indispensable tool in the toolroom or home workshop. Vises are usually mounted on a workbench, or a similar firm support, to hold the material to be worked on.

There are seven basic categories of vises and many special purpose vises. While most of these vises can be used for a wide variety of work, it is important to select the vise most suitable for the prime application and strong enough for any work required.

TYPE	CHIEF APPLICATION
Machinist's Vise	Heavy industrial work
Utility or workshop Vise	Light work and home workshop
Automotive Vise	Service station work
Woodworker's Vise	Carpentry and general wood work
Pipe Vise	Plumbing and pipe work
Milling Machine Vise	Milling machine work
Drill Press Vise	Holding work on a drill press

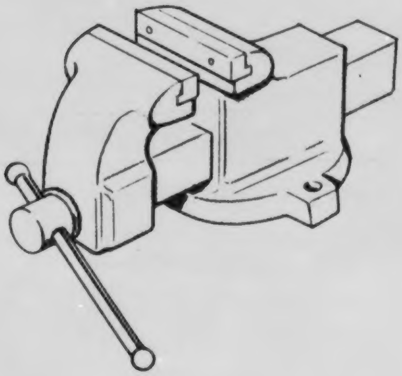
It is important to mount any vise with the stationary jaw projecting slightly beyond the edge of the workbench so that long work can then be clamped in the vise without interference from the edge of the workbench.



THE MACHINIST'S VISE

This designation applies to the strongest, heavy-duty vises made. They are designed to withstand the great strains in industrial work and similar applications. These vises are available in jaw widths of three to eight inches. Models are made with stationary bases, swivel bases, pipe jaws (combination vises), with replaceable jaw inserts, and even with jaws that swivel.

Special purpose vises include the SHEET METAL WORKER'S VISE (thin, tapered jaws that allow close work) and HYDRAULIC models with a rapid movement of the sliding jaw. Smooth jaw models and copper jaw caps are available to prevent possible marring of the work.

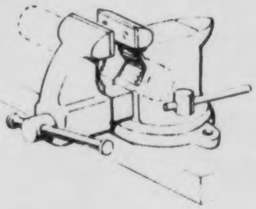


The machinist's vise should always be bolted, never screwed, to the workbench.

THE UTILITY VISE

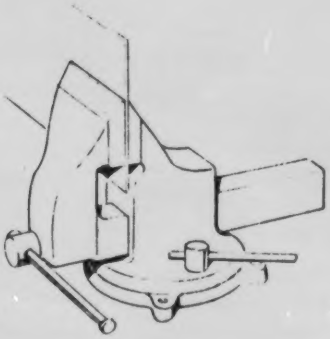
This is a lighter duty version of the machinist's vise. It usually has pipe jaws located below the flat jaw facings and comes in jaw widths from three to five inches. The Acme thread, or the screw that draws the jaws together, may or may not be exposed. Very light-duty vises are also available, some having jaws as small as two inches.

The utility vise, like the machinist's vise, should also be bolted to the workbench top, never screwed in place.

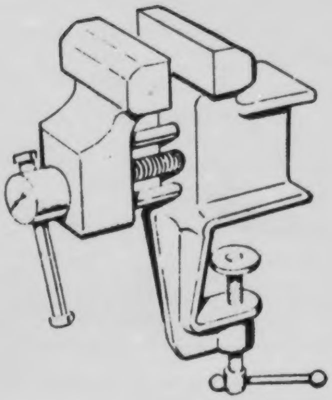


THE AUTOMOTIVE VISE

The AUTOMOTIVE VISE is specifically designed for the automobile aftermarket, such as: service stations, garages, and automobile and truck agencies. This vise has the combined features of the machinist's and workshop vises. It has the pipe jaws and economy of the workshop vise with a machined bench plate having a 360-degree swivel and the positive lock feature of the machinist's vise.



The sheet metal vise has a deep throat and thin, tapered jaws to allow for close work. The jaws on this type of vise are smooth.



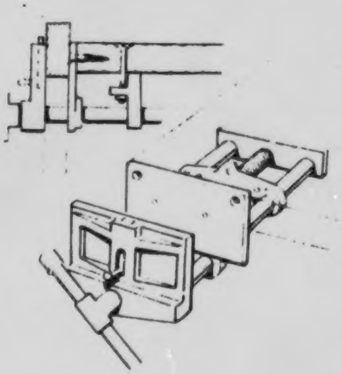
The clamp-on vise can be quickly mounted at the edge of any convenient work surface.

WOODWORKER'S VISE

The WOODWORKER'S VISE (sometimes know as the CARPENTER'S VISE) is used when working with wood. To protect the work, and to get a good grip on large pieces of wood, the jaws on these vises are much larger than the jaws on other vises; generally being four by seven inches and even larger--four by ten inches. This type of vise is available with a rapid-action nut which allows the movable jaw to be moved in and out quickly. The final tightening can be done by turning the handle a half turn or so.

If the jaws are of metal, they are always lined with hardboard or hard wood to protect the work.

The woodworker's vise is bolted to the underside of the workbench. Mount it so the top of the vise jaw is flush with the surface of the bench and flush with the corner of the bench.

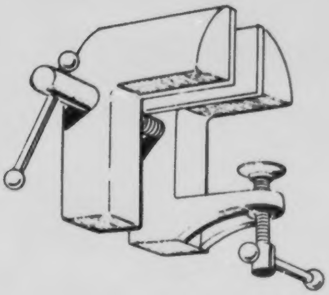


CLAMP-ON VISES

These are generally used for light-duty work. Instead of being bolted to the workbench, they are clamped to the workbench with a type of C-clamp arrangement. One of their benefits is their portability, as they can be quickly moved from place to place.

Smaller vises for working with wood also have a C-clamp arrangement for mounting. They are made of metal, but the jaws are lined with hardboard to protect the work. The large vises usually have drilled and tapped holes so that liners of wood can be mounted in the jaws to prevent marring the work.

A well-equipped shop may have a metal-working vise mounted at the left side of the workbench and a woodworking vise mounted at the right.

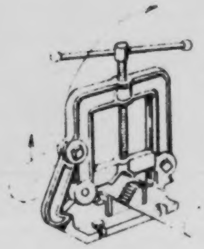


The clamp-on vise, designed for woodworkers, has jaws lined with hardboard to protect the surface of the work.

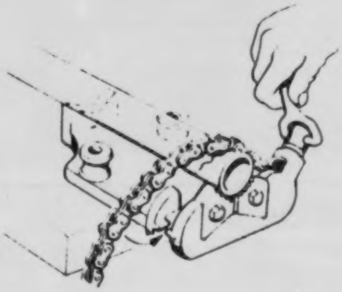
PIPE VISES

PIPE VISES are especially designed to hold pipe or round stock. They are often mounted on trucks and beams as well as on workbenches. They are available with capacities to hold pipe up to eight inches in diameter. The two main types are the YOKE VISE and the CHAIN VISE, with the latter especially designed to hold irregular work. Both types are available with tripods and are called TRIPOD VISES. A CLAMP KIT VISE can be mounted without drilling holes for a temporary attachment where light-duty work is to be performed.

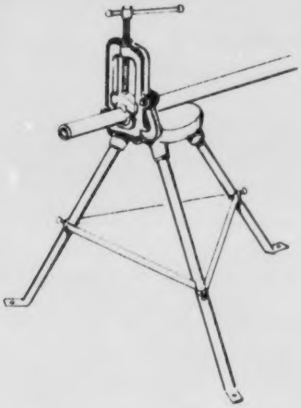
Pipe vises are made in a number of difference forms, including vises with bolt holes for permanent mounting and portable vises with clamp attachments for temporary mounting on benches, studs, posts, etc.



The yoke type vise is bolted to the workbench. Note the hinge at one end and the hook at the other so that the pipe need not be "threaded" through the vise jaws to be worked on.

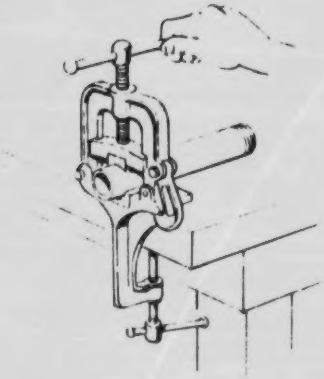


The chain vise is designed to hold pipe as well as irregular work. Work is released from the vise by loosening the nut and then removing the pipe--or other work--from the vise. This allows the pipe to be installed or removed without having to slide its entire length through the vise.



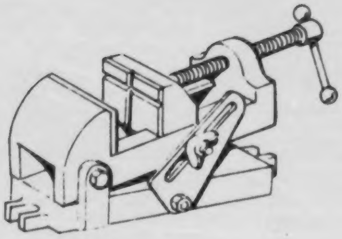
The yoke type vise and the chain vise are available in portable workbench models with a tripod stand.

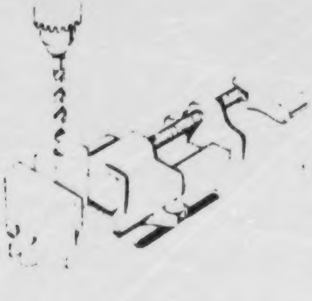
The clamp kit vise can be temporarily mounted without drilling holes (sometimes on the nearest 2x4) for light-duty work.



THE DRILL PRESS VISE

As its name indicates, this vise is used in conjunction with a drill press. The jaws are made so that it will accept round, square, or oddly-shaped work and hold it firmly in place. Some have a quick release feature--the movable jaw can be quickly moved up to the work, or away from the work, without turning the handle. The handle is then used for the final half-turn or so to loosen or tighten the jaws.

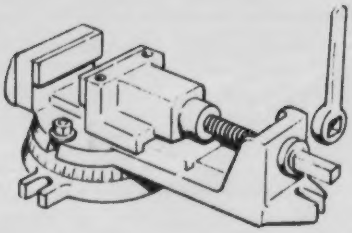


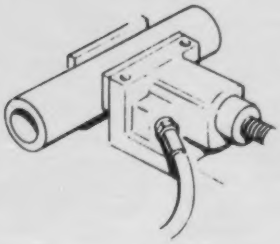


The drill press vise should be securely bolted to the drill press table through the lugs provided in the base of the vise. Some drill press vises, as shown in the upper drawing, are adjustable and can be used for drilling holes at an angle.

MILLING MACHINE VISE

These vises, used with milling machines, have a swivel base graduated in the degrees of a circle. They are also available with an air-hydraulic operating system.





Milling machine vises, used in machine shops, are made with graduated swivel and stationary bases. They are also available for power operation using an air-hydraulic system CAUTION: MAKE SURE THE BASE IS SECURELY BOLTED TO THE BED OF THE MACHINE.

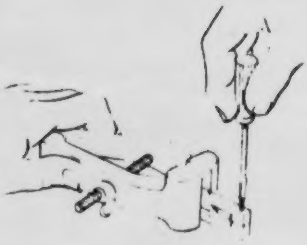
SPECIALTY VISES

HYDRAULIC VISES. Two types are available. One kind has a built-in hydraulic booster-reservoir to multiply the power of the hand as the handle is turned. The other type, used in production work, operates by means of an air-hydraulic system controlled with a foot pedal. The big advantage with such a vise is the amount of time saved in installing and removing the work, and the extra tightness with which it holds the work.

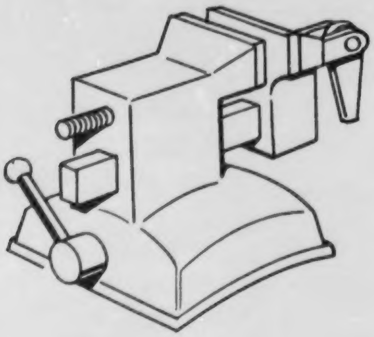
MODEL MAKER'S VISE. This is a light-duty vise with two-inch jaws, hand held for use with small work. The jaws are tightened by means of a thumb nut. Model railroad fans and model airplane workers use these vises.

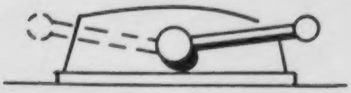
The model maker's vise is usually hand held, as shown, and can be used for holding small parts to be assembled or worked on. It can also be mounted on a larger vise when the use of both hands is required.

CAUTION: DO NOT OVERTIGHTEN THE JAWS OF THE VISE.



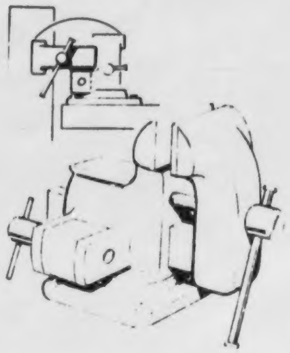
VACUUM BASE VISES. These vises require even less work to mount than the clamp-on vises. Their base consists of a rubber pad which is arched in a concave shape by means of a lever. When the vise is placed on a smooth surface and the lever is turned, a vacuum is created that firmly holds the vise in place. These vises, of course, are designed for comparatively light duty work.



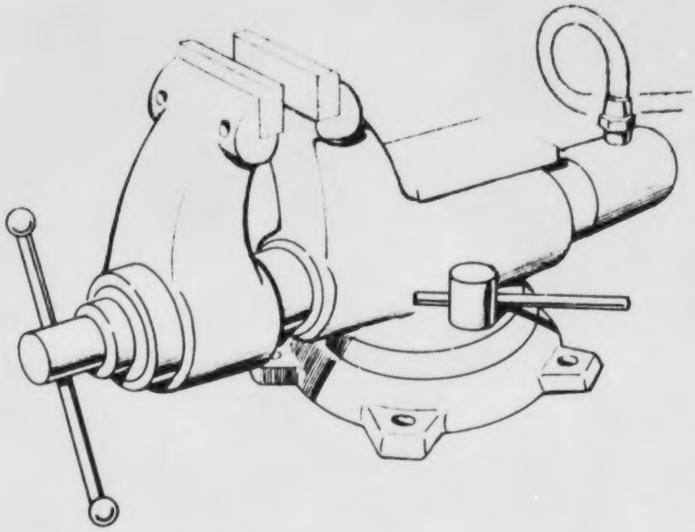


The vacuum base vise can only be fastened to a smooth, non-porous surface. A handle, moved as indicated, creates a vacuum that secures the vise to the table's surface. Such vises are used only for light duty work.

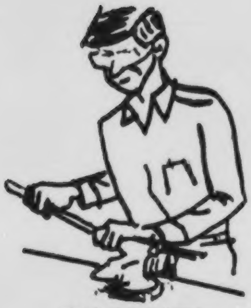
This type of vise is designed so that it can be flipped to hold the work in a vertical position, as shown in the small illustration. After flipping, an auxiliary handle is used to keep the jaws in their new position.



The hobby vise, used by model makers and other workers of this type, has a clamping arrangement in its base that allows it to be tilted in practically any direction and then firmly locked in place.

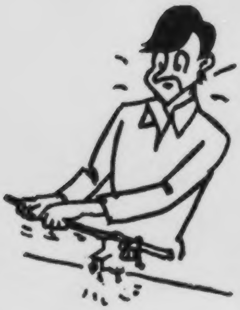


The air-hydraulic vise opens and closes by means of a foot control. It locks on to the work with a force of more than 2,000 pounds. It is made with stationary and swivel bases in jaw widths up to six inches.



RIGHT

Use a vise large enough to hold the work without strain. The base of the vise should be bolted to a smooth, even surface to prevent unnecessary stresses to the base when the vise is in use. Note that Careful Cal has the vise bolted to the bench.



WRONG

Don't try to bend a heavy rod in a light vise. Harry has now ripped the vise from its moorings. And he still couldn't bend the rod that's shown.

DO'S AND DON'TS WHEN USING A VISE

1. Use bolts in all the holes in the base of the vise.
2. Use lock washers under the nuts.
3. Do not use the jaws of the vise as an anvil.
4. When work is held in the vise for sawing, saw as close to the jaws as possible (to prevent vibration). Be careful not to cut into the jaws.
5. When clamping extra long work, support the far end of the work rather than putting extra pressure on the vise.
6. Avoid clamping the work with heavy pressure at the corner of the vise jaws, as this may break off a corner of a jaw.
7. Wear safety glasses when hammering or pounding on an object held by the vise.
8. Replace a bent handle.
9. Replace worn jaw inserts.
10. Adjust for play between the nut and screw or replace them when excessive play develops in the handle.
11. Lightly oil all moving parts.
12. Never use an extension handle for extra clamping pressure.
13. Use jaw liners with a vise if there is any possibility of marring the work.
14. If the threaded part of the vise is exposed, keep it free of chips and dirt.
15. Discard any vise that exhibits the slightest hairline fracture.
16. Never pound on the handle to tighten beyond hand pressure.
17. Never try to repair a vise by welding or brazing.

CLAMPS

Clamps are first cousins to vises. The most common relative is the C-clamp. C-clamps vary in size from tiny 3/4-inch clamps to clamps with a 12-inch capacity. They may be made from stampings, castings, or drop-forged. Most clamps use a wing nut, or a sliding pin-type handle, for tightening and securing the work. Heavy-duty clamps may have screws that end in a square head, and the tightening is done with a wrench. The swivel at the end of the screw allows the screw to position itself without marring the work, especially if the work is not at an exact right angle to the screw. However, tool-maker's clamps are made without swivels in order to assure accurate positioning.

Remember that C-clamps only serve as temporary devices for holding the work securely in place. Clamps should be removed from the work as soon as the required job has been finished.

The finest clamp, like any fine tool, can be damaged by rough handling, improper job selection, and overloading. Keep C-clamps in racks when not in use to protect them from damage. Use clamps of the proper capacity. A railroad spike shouldn't be driven with a tack hammer--neither should a heavy-duty clamp be used where a small, light-duty clamp will do the job.

Always select the clamp to match the job by ascertaining the following:

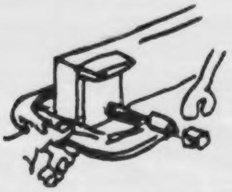
What is the required opening?

What is the required depth?

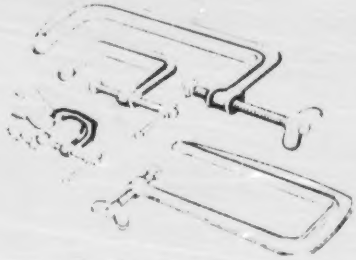
What strength and weight are required?

Is the full length of the screw really needed? The hindrance of an extended screw beyond the frame can be eliminated by selecting a clamp with a shorter screw.

Evaluate the TYPE of clamp to use--bar clamp, C-clamp, spring clamp, etc. Using the right type of clamp will save time.



This type of extra heavy-duty forged-steel clamp uses a wrench for tightening.

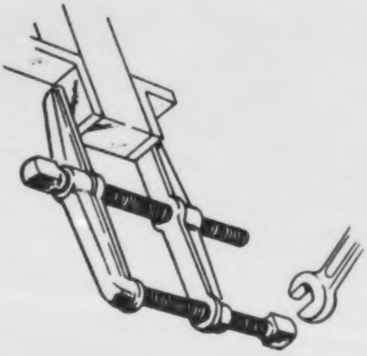


Typical C-clamps

MACHINIST'S CLAMPS

MACHINIST'S CLAMPS somewhat resemble C-clamps but are made entirely of drop-forged steel. Their jaws are parallel to each other; they cannot be set to non-parallel positions. Two screws, one in the center and one at the end, are used to tighten the clamp against the work.

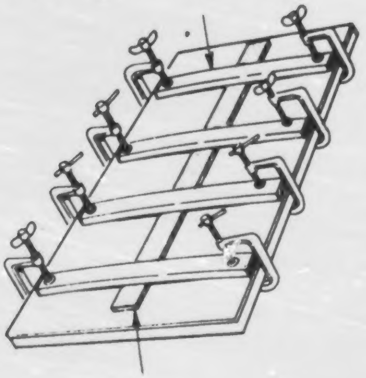
Always choose a clamp in relation to the work involved. Too large a clamp may prove to be an awkward obstruction causing hazardous working conditions, while too small a clamp will not provide adequate pressure to hold the work securely.



The machinist's clamp, designed for pattern-making and machine shop use, is made of tough steel and is heat-treated for extra strength.

DEEP THROAT CLAMPS

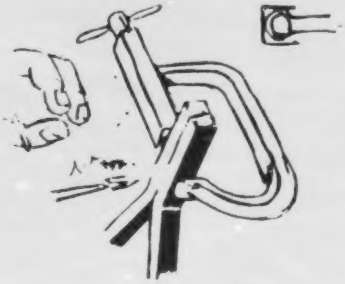
As a general rule, the larger the clamp, the deeper the throat. However, there is no need to go to extra large clamps just for the sake of the extra wide throat capacity that may be needed. The job can quite often be accomplished by using special clamps that have an extra deep throat, even though their overall size may be quite small in relation to the throat.

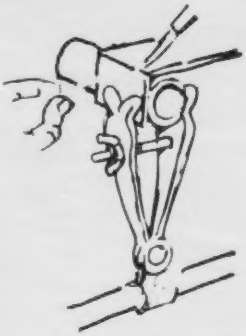


This shows a number of C-clamps can be used to apply pressure to the center of a panel. The 1x2-inch boards transmit the pressure applied to them by the C-clamps to the 1x3-inch board in the middle. This technique is useful when gluing up large panels or veneering a door.

WELDER'S CLAMPS

WELDER'S CLAMPS are specially protected to prevent welding spatter from adhering to and eventually ruining the clamp. Its parts may be coated with a spatter-resistant plating (copper or cadmium). In addition, welder's clamps are made with shields to protect the screw against damage.

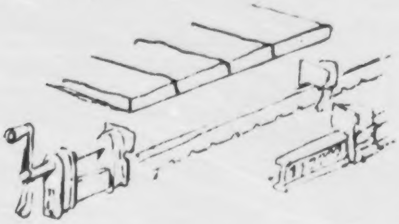

The welder's clamp


Another type of welder's clamp that is especially handy for holding odd-shaped work.

BAR CLAMPS

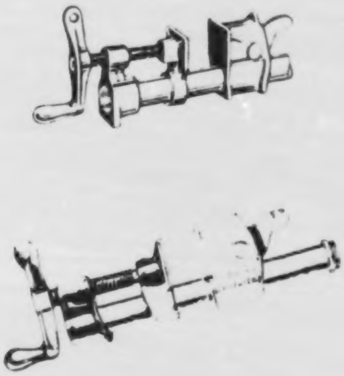
A variation of the C-clamp is the BAR CLAMP. It consists of a steel bar with a fixed jaw at one end and a sliding or adjustable part that has a screw with a handle and swivel. When in use, the sliding part that has the screw is pushed up to the work, and the handle is then turned to tighten the clamp. Bar clamps vary in size from six inches to six feet in length.

One version of the bar clamp has a series of notches cut into the bottom of the bar, every three inches or so, to engage the movable part of the clamp. Another version has indentations in the bar. A pawl on the sliding part of the bar engages the indentation nearest the work. Then the crank is used for the final tightening. The threaded part of the clamp should be kept lightly oiled and the pawl should always operate freely.


The bar clamp is extremely useful for gluing up extra wide work, as shown in the figure.

Pipe Clamps

A close relative of the bar clamp is the PIPE CLAMP. It is used with 1/2-inch or 3/4-inch pipe. The pipe is screwed into a fixed jaw, and a movable adjustable jaw is installed on the other end of the pipe. In use, the back stop is pushed up to the work and the handle or crank of the clamp is turned to secure the work. The capacity of the pipe clamp is only limited to the length of the pipe available.



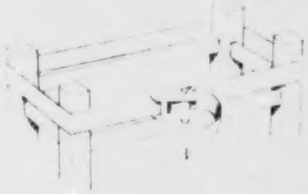
Both of these pipe clamps operate on the same principle. Their mechanism is mounted on 1/2 inch or 3/4 inch pipe. The clamp has its threaded part screwed to the end of the pipe while the backup part can be slid along the pipe to the desired spot.

Web Clamps

These clamps have a heavy-duty nylon or canvas strap which is wrapped around the work to be glued or held together. By means of a ratchet, the web (or strap) is drawn together to apply the required pressure. The web clamp is especially useful for gluing large work (such as the outside edge of a table), as its capacity is limited only to the length of the strap.

Caution: Inspect the web for fraying or cuts before applying pressure, as the ratchet action of the clamp develops tremendous pressure.

Keep these clamps rolled up when not in use. Be sure to remove all tangles and knots before applying the clamp to the work. The nylon belts are tightened with a small wrench while the heavy-duty canvas belts are tightened with their own built-in clamping handles.

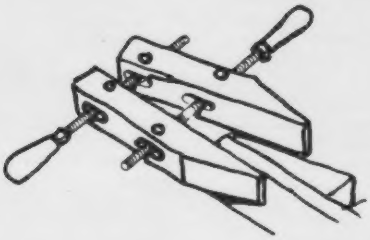


The web or strap clamp is made of canvas or nylon. Its great advantage is that it can be used to apply pressure to large and oddly-shaped work.

THE HAND SCREW

The HAND SCREW, or CABINET MAKER'S CLAMP, can be used to clamp work whose sides are not parallel to each other. This clamp has two screws, one with a left-hand thread and the other with a right-hand thread. The openings through which the screws pass are slightly elongated so that the jaws can assume a non-parallel position--if necessary--to match the surfaces of the work. The jaws move in opposite directions due to the action of the right and left-hand threads as the handles are turned.

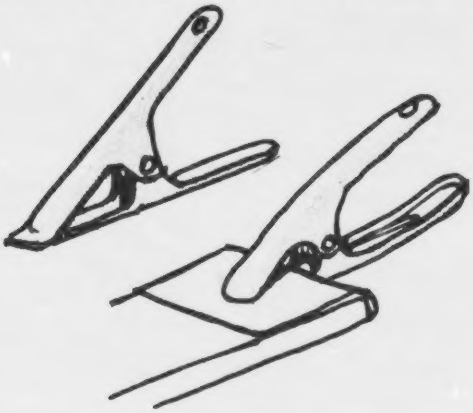
Keep the threaded rods of these clamps lightly oiled. Make certain that there is no oil on the jaws. Keep the jaws smooth to protect the work.



The hand screw can be adjusted to clamp work whose sides are not parallel to each other. The smooth, hardwood jaws protect the finish of the work by spreading the pressure over a broad surface. One end of each spindle has a left-hand thread; the other end has a right-hand thread.

SPRING CLAMPS

While most people associate spring clamps with light-duty work, some spring clamps exert so much pressure that two hands are needed to open their jaws. These clamps range in size from two to nine inches in length and are available with vinyl padded jaws to protect the work. Use them only where moderate pressure is required for gluing or for holding work in place while some other operation is to take place.

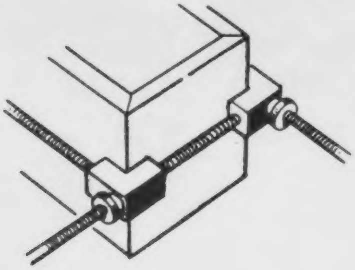


The spring clamp is not to be sneezed at--it is for clamping! These clamps range in size from two to nine inches and are generally used for light-duty clamping. The holes at the handle ends are for hanging them up when not in use.

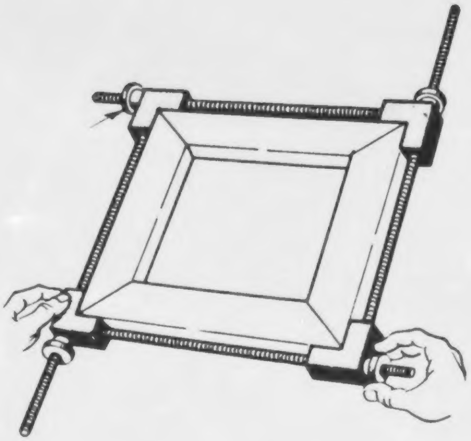
MITER CLAMPS

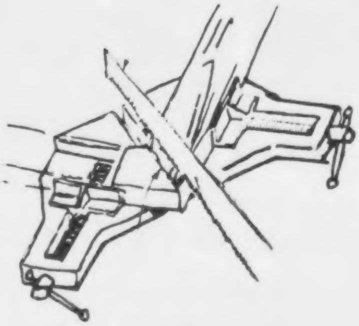
The MITER CLAMP is used to apply simultaneous pressure to all four joints of a square or rectangular frame. Two common types are illustrated. However, ordinary C-clamps can also be used rather effectively to glue corner joints, as shown in the drawing below.

CAUTION: Test for squareness at EACH corner before applying final pressure.

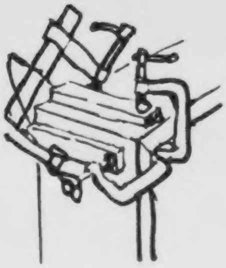


This clamp is especially designed to apply pressure while gluing mitered corners (such as picture frames). A thumb nut is at each corner. This clamp can also be dismantled for use when all four clamps are not needed, as shown in the drawing at the top.

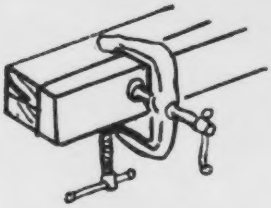




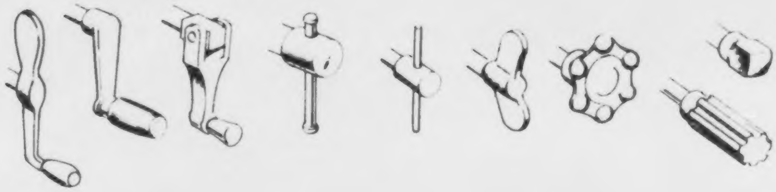
The corner clamp has a dual function. It can be used to hold mitered corners together while the glue sets, and it can also be used as a jig for cutting 45 degree miters.



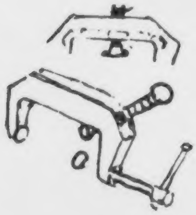
Ordinary C-clamps can be used to apply pressure for gluing up a mitered corner.



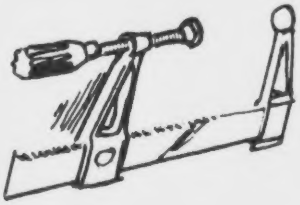
The three-way clamp. This is an ingenious clamping device that allows pressure to be applied in two directions, as shown. It is extremely handy for applying veneers to table edges.



Types of handles used to tighten C-clamps and bar clamps.



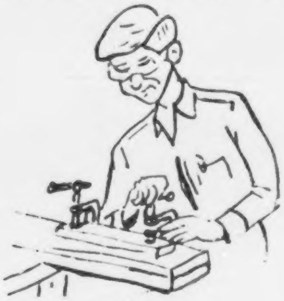
This unusual C-clamp has a slot along its back and a spring-loaded threaded post which passes through the slot. The post can be positioned anywhere along the slot where it will do the most good and then tightened in place. Note the nut at the bottom which engages the post.



This type of clamp features a serrated bar. It is used by pushing the movable part of the clamp up to the work and turning the handle for the final tightening.

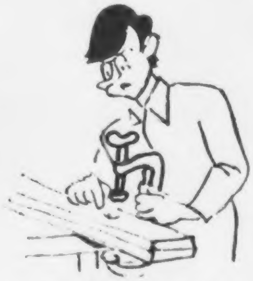
DO'S AND DON'TS WHEN USING CLAMPS

1. Store C-clamps by clamping them in a rack, not in a drawer.
2. Use pads with C-clamps to avoid marring the work.
3. Discard any clamp that has a bent frame or a bent spindle.
4. Do not use a wrench, pipe, hammer, or pliers to gain extra tightening. A wrench should be used only on those clamps especially designed for tightening with a wrench.
5. Keep all moving parts lightly oiled and clean. Make sure there is no dirt or oil on any part that will come in contact with the work.
6. Make sure the swivel at the end of the screw is turning freely before using.
7. Never use a C-clamp for hoisting work. Special lifting clamps are made for this purpose.
8. Avoid using extra large clamps just for the sake of their large throats; instead, use deep-throat clamps.
9. Never use a C-clamp for hoisting or for supporting a scaffold or platform that may be used to carry people.
10. Do not use C-clamps for securing a load that may be carried over a public highway; vibration may cause the clamps to loosen and the load to break loose.



RIGHT

Careful Cal knows enough to use the right size clamp and he places scrap wood under the clamps to avoid marring the surface of the work.



WRONG

Too big a clamp and too much pressure will leave a dimple in the work. Hazardous Harry never seems to have heard that pads should be used with C-clamps to avoid dimples.

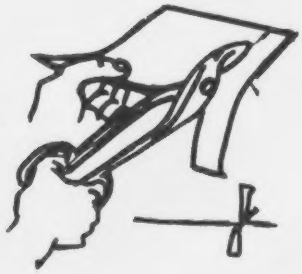
SNIPS

SNIPS, sometimes called tinner's snips, are used to cut sheet metal. They are used by the sheet metal worker and the automotive mechanic in industrial plants, and by the home owner.

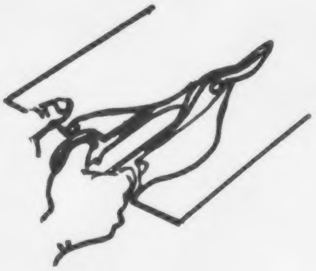
While their primary purpose is to cut sheet metal, snips are also used to cut screening, chicken wire fencing, steel strapping, gaskets, linoleum, canvas, and other hard-to-cut materials. Large snips for cutting heavy metal are sometimes called shears. Snips are generally used to cut light sheet metal. Cutting capacity is in relation to overall length. The longer the snip, the more leverage and cutting capacity it has. The aviation-type snip has compound leverage and will cut heavier sheet metal.

There are four basic types in common use today: the straight pattern, the combination, the duckbill pattern, and the compound leverage snips (usually called aviation snips).

STRAIGHT PATTERN SNIPS are generally used for making straight line cuts, although curved cuts can be made if the curve is not too sharp. Their cutting edges are sharpened at an angle of 78 to 85 degrees to the inside of the blade. The sizes range from 7 to 16 inches in overall length, with the most popular sizes being 7, 10, and 12 1/2 inches.



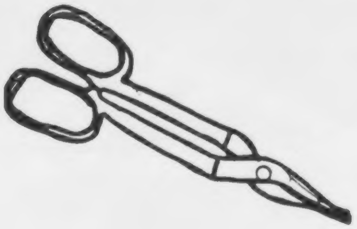
The straight pattern snips are generally used for making straight cuts. They can also be used for making shallow curves.



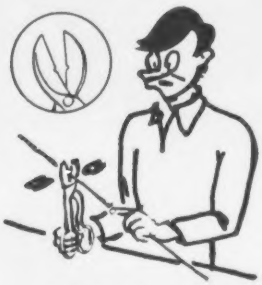
The combination snip can be used for straight cutting as well as for cutting curves. Keep the blades sharp and make certain that the bolt holding the blades together is tight; looseness between the blades will cause ragged cuts.

COMBINATION AND DUCKBILL snips are used for cutting curves in either direction. They can be used for straight cutting. However, to the shape of the blades, they will bend the metal more and will require slightly more effort to cut with than the straight pattern snip. The most popular sizes are 7, 10, and 12 1/2 inches, although 14- and 16-inch sizes are available. The thickness of the metal that can be cut is approximately the same as for the straight pattern snip.

The duckbill snip will cut smooth curves in sheet metal in either direction. They can also be used for straight cuts, but not as satisfactorily as the regular straight pattern snips.

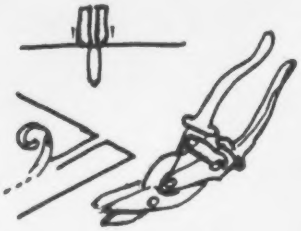


There are other types of snips available, such as the CURVED BLADE (circular), BULLDOG, LIGHT METAL, and JEWELER'S. These are used mainly by the professional metal worker or in a specialized profession. There are also straight and combination snips available which have a high carbon or alloy steel blade welded to the basic snip frame. They do not cut any easier than a regular solid steel snip, but will stay sharp longer. Snips are made for right-handed use although they can be used in either hand.



WRONG

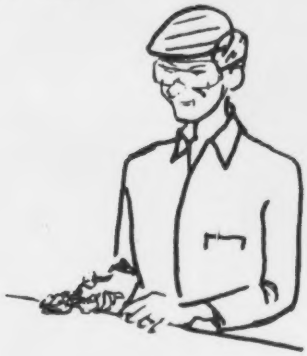
Hazardous Harry is using snips to cut heavy wire. It may work, but he could ruin the cutting edge of the snips--leaving a nick in the blades. Also, the next time he tries to cut sheet metal with these snips, he will get a ragged edge. Too bad Harry!



Pipe and duct snips have a compound action. This type of snip cuts out a narrow section of metal equal to the width of the center blade. The work on either side of the blade tends to stay flat, as only the narrow waste takes a curl as it is cut out. It is ideal for cutting panel openings in gutter and downspout work where metal distortion on either side of the cut is not wanted.

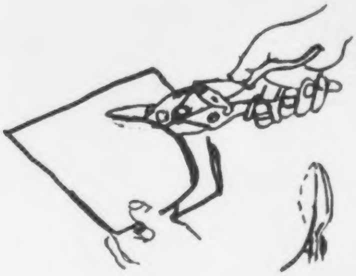
COMPOUND LEVERAGE SNIPS (commonly called AVIATION SNIPS) are becoming popular in all fields of metal working. Their double fulcrum compound-lever action requires less effort to cut the metal. The blades of these snips are usually made from an alloy steel so that they are harder and tougher than regular snips. Standard size for the professional-type aviation snip is ten inches overall.

AVIATION SNIPS are available in three types of cut: straight for cutting straight lines; left hand for cutting curves to the left; and right hand for cutting curves to the right. These snips are generally used for heating, air-conditioning, gutter work, and for general industrial use.

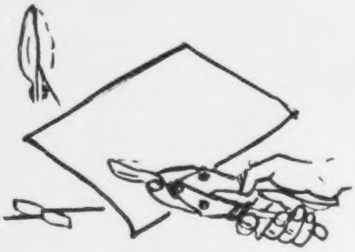


RIGHT

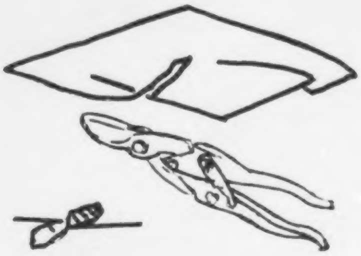
Careful Cal knows enough that only wire cutters should be used to cut wire. Metal cutting snips are for cutting sheet metal, not wire.



Left cut snips will make straight cuts as well as cuts to the left, as shown in the drawing.



Right cut snips are for making cuts to the right as well as straight cuts.

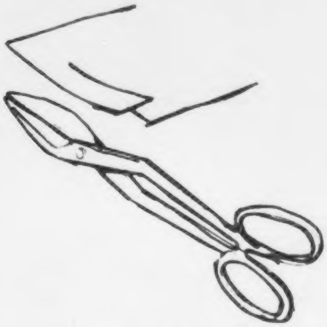


Straight cut snips are used for making straight cuts as well as shallow cuts to the right or left.

PROPER USE OF SNIPS

It is not advisable to cut exactly on the layout line (to avoid extra finishing work). It is good practice to leave about 1/32-inch of metal beyond the layout line for final dressing and finishing. As the cut is being made, try not to make the cut the full length of the blades. If the points of the blades are allowed to meet at the end of the cut, the sheet metal will have a tendency to tear as the cut is completed. Stop the cut about 1/4-inch before the tip of the blades and then take a fresh bite.

When cutting a large sheet of metal, it is best to cut at the left side of the sheet. This way the waste will be curling up and out of the way while the rest of the sheet will remain flat. Of course, this rule applies only if one is right-handed.



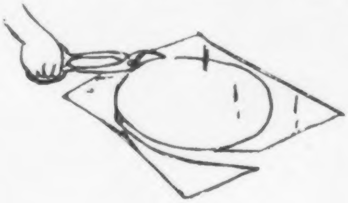
If right-handed, cut so that the waste is on the left, as shown in the figure.

When making a straight cut, place the work over the workbench so that the layout line is slightly beyond the edge of the bench. Hold the snips so that the blades are at an exact right angle to the sheet metal. The edges of the metal will be bent and even burred if the blades are not at right angles to the work.

In order to make a large hole in sheet metal, start by making a hole in the center of the sheet and proceed to make a spiral cut leading out to the desired circumference. Keep cutting away until all the non-wanted material is removed.

To cut a disk in sheet metal, start from the outside and make a cut tangent to the layout line but slightly beyond it to allow for dressing and finishing. This way one can always see the layout line and still have material left over for the final dressing and finishing.

To cut a disk out of sheet metal a curve-cutting snip should be used.



DO'S AND DON'TS WHEN USING SNIPS

1. Wear safety goggles and gloves when working with snips.

2. Be careful of the sharp edges on the cutting edges of these tools.

3. Never cut sheet metal that is thicker than 0.062 inches.

4. Use snips for cutting soft metal only. Hard, or hardened, metal may damage the cutting edges of the snips.

5. Use the right size and type of snips for the job to be done. Don't try to cut sharp curves with straight cut snips.

6. Avoid springing the blades. This is the result of trying to cut metal that is too thick for the snips that are being used or from trying to cut heavy wire or nails.

7. Use only hand pressure for cutting. Do not hammer or use the foot to get extra pressure on the cutting edges. If one has to resort to such a technique, he is using too small a snip--the metal is too thick for the capacity of the snip.

8. Snips are cutting tools, Protect their edges. Wipe the cutting edges with a lightly oiled rag. Store them in a rack; don't dump them in a drawer.

9. Oil the pivot bolt on the snips occasionally.

10. Keep the nut on the bolt properly adjusted at all times.

11. Care should be used when sharpening snips with a grinding wheel. Dip the blades in water frequently to avoid overheating.

12. Sharpen the edge by grinding or filing from the outside towards the inside edge. The burr that remains will be removed by slowly closing the snip after it has been sharpened.

13. Never sharpen the inside ground surface of a snip. This will ruin the cutting action.

14. Never try to sharpen an aviation-type snip. This will remove the serrations and the sheet metal will slip out of the blades when one tries to cut.

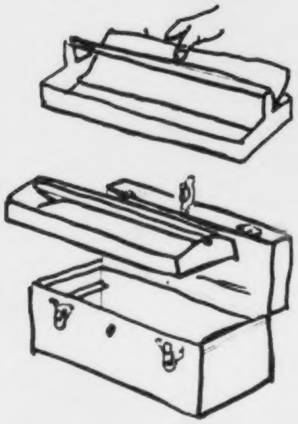
15. Don't use snips as a hammer, screwdriver, or pry bar. THERE ARE TOOLS FOR SUCH PURPOSES--USE THEM.

    If the snips have locking clips, use them when the tools are not in use.

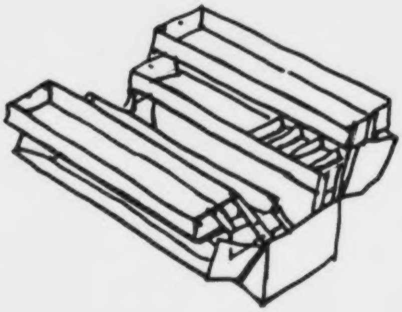
TOOL BOXES, CHESTS, AND CABINETS

First of all, tool boxes are meant to hold tools. They are not to stand on, to be used as an anvil, as a saw horse, or to store one's lunch. Light-weight tool boxes are made of plastic or steel, but strong, heavy-duty tool boxes are made only of steel. Steel tool boxes can be divided into three classes: HAND BOXES, CHESTS, and CABINETS. Cabinets are mounted on casters while the smaller tool boxes (some with drawers and some without) are designed to be hand carried.

Consider the portable type first. These may have up to five drawers, a lift-out tray, and possibly a cantilevered tray that automatically opens out when the cover is lifted. All seams should be welded and smooth with no protruding edges to catch the clothing or hands. In addition to the handle on the top of the tool box cover, look for handles at each end for those boxes designed to hold an extra heavy load of tools. A good tool box will have a catch or a hasp at each end and should be able to be locked with either a padlock or its own built-in lock. Look for weatherproof construction that will allow rain to drain away without entering the inside of the tool box.



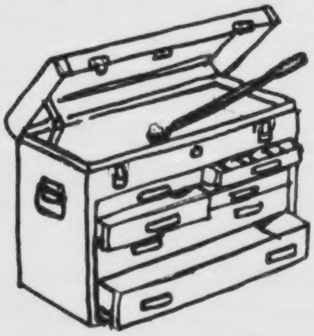
A tool box with a lift-out tray. Protect the tools by lining the bottom of the box and tray with felt.



This tool box has lever-operated trays that open automatically as the cover is lifted.

TOOL CHESTS are big brothers to tool boxes. They are usually heavier, stronger, and, of course, have a much greater capacity than tool boxes. The drawers (as many as ten and even more) on the better models can be secured with their own built-in locks. Some have a tote tray that can be removed for carrying only those tools needed for a particular job. Most tool chests are designed to be placed on top of tool cabinets.

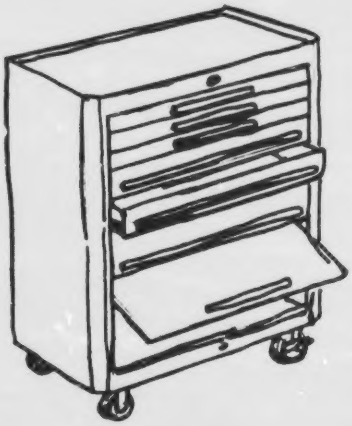
It is always a good idea to line the bottoms of the drawers with a soft material, such as felt or scrap carpeting, to protect the tools. This applies especially to drawers holding tools with cutting edges.



Tool chests, more substantial than tool boxes, may have from two to ten drawers.

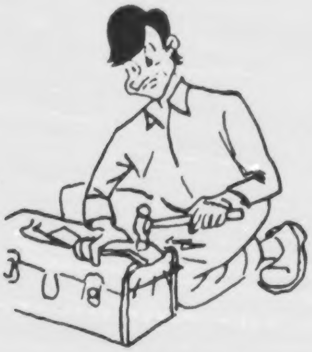
MOBILE TOOL CABINETS may have ten or more drawers. If they are designed to hold a chest, they may have as many as twenty or more drawers. Look for a locking arrangement that will lock all of the drawers automatically and for construction that will allow the drawers, no matter how heavily loaded, to roll out freely. Casters should be of ball-bearing construction with two wheels that can be locked by means of a brake to prevent rolling. A good tool cabinet should be adequately braced to prevent any possibility of swaying as the tool cabinet is rolled around.

Tool cabinets are always mounted on casters. Chests can be added to the top of the cabinet.



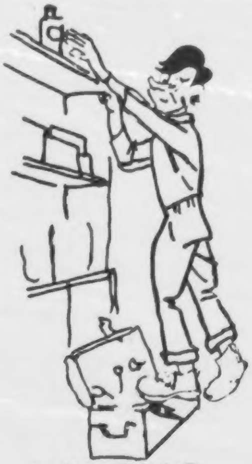
TAKING CARE OF TOOL BOXES, CHESTS, AND CABINETS

1. Lightly oil all moving parts (such as drawers, trays, and hinges) at regular intervals.
2. Use graphite, not oil, on the locks and padlocks.
3. Touch up all rusted spots and pay particular attention to the bottom of the tool box.
4. Make sure that the wheels on tool cabinets are turning freely.
5. Drawers and trays that hold sharp-edged tools (chisels, screwdrivers, etc.) should be lined with cork, felt, or scrap carpeting.
6. Check the handle. Is it firmly attached to the tool box?
7. Keep the tool box or chest locked when it's not in use.
8. Sand, or file down, any sharp edges that may cause damage to clothes or fingers. Such sharp edges are usually caused by dropping the tool box to the floor instead of placing it on the floor.
9. Always replace the tools in the same tray or drawer from which they came. Use this system and no time will be wasted hunting for a particular tool that is "just there."
10. Wipe away all grease and moisture from tools before storing them in the tool box, chest, or cabinet.



WRONG

Harry is in trouble again. Never use a tool box for an anvil or any similar purpose.

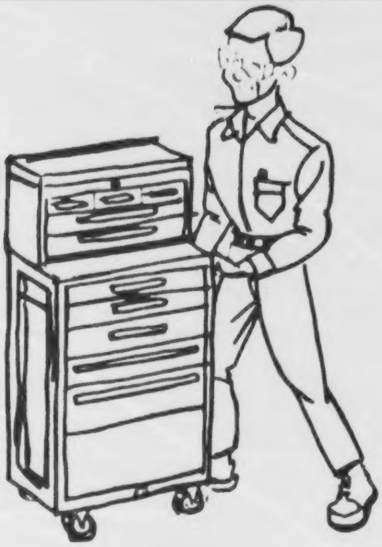


WRONG

What's the matter with Harry? Hasn't he ever heard of using a ladder to get to hard-to-reach items?

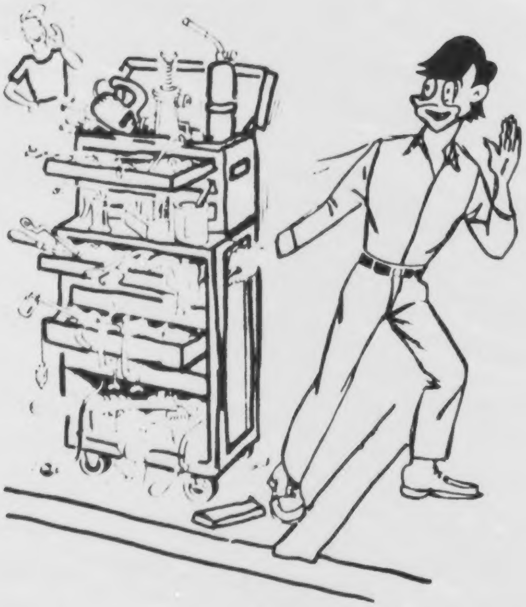
DO'S AND DON'TS FOR TOOL BOXES, CHESTS, AND CABINETS

1. Don't pull a tool cabinet as this prevents seeing where one is headed. The operator should push it in front of himself.
2. Do not stack a tool cabinet with too many extra chests or tool trays. It may tip over at the most unexpected time.
3. Do not open up too many loaded drawers at one time. Close each drawer before opening up another. Heavily-loaded open drawers are an invitation to tipping.
4. Lock all drawers before trying to roll the tool cabinet into a new work area.
5. Do not roll a tool cabinet too quickly. A pot hole in the floor, or some hardware on the floor, may cause an accident.
6. Don't use a tool cabinet for a workbench.
7. Don't overload the drawers. If there isn't room for all of the tools, a larger tool cabinet or chest is needed.
8. Do not roll a tool cabinet with loose tools or parts lying on top of the cabinet.
9. Set the brakes on the locking casters after the cabinet has been rolled to the work area.
10. Treat a tool cabinet, chest, or tool box, with respect. It can help one earn a living.
11. Tool boxes should be labeled. It is also a good idea to scratch one's initials or name on the most valuable tools.
12. A tool box loaded with an extra heavy load of tools will be easier to move if small casters are mounted at each corner. Use the plate-type caster with rubber wheels. Check the load limit of the casters before installing them.



RIGHT

Careful Cal knows enough to close all the drawers before moving his tool cabinet. In addition, he is keeping an eye on where he is headed.



WRONG

Now look at Harry. If he is going to pull that tool cabinet, he is sure to lose some of his tools from those open drawers, trip over any obstacles on the floor, and even dump the cabinet on its side. Harry should never pull a tool cabinet. He should push it--and look where he is headed.

REFERENCES

Materials were selected and reviewed from the following sources and in some instances were incorporated in the production of the preceding unit.

Hand Tools Institute, 707 Westchester Ave., White Plains, NY., 10604

National Institute for Occupational Safety and Health

CHINA AND GLASSWARE

1. Discard any chipped or cracked china and glassware.
2. Never use glassware in forming or preparing food.
3. Never force a towel inside a glass to dry it.
4. Never clean up broken china or glassware with hands, use a dustpan and brush or broom.
5. Never place glassware in soapy water.
6. When carrying from one place to another, be alert and move cautiously.
7. Never dip glassware into ice machine, use a scoop.
8. Never place hands or fingers in glass to carry or pick up.
9. Place glassware, dishes, and silverware in separate bus tubs to prevent breakage.
10. Store glasses upside down on a clean surface so contaminants do not settle in them.
11. Use a damp paper towel for cleaning up slivers of glass or china.

DRAIN CLEANERS

The effectiveness of these products is due to the presence of highly corrosive chemicals. What works so effectively in a drain will unfortunately work just as strongly on the skin or in the eyes. The damage can be even more severe if the drain cleaner is swallowed.

PURCHASE

1. Before buying see if the blockage can be cleared away with a plunger or a flexible wire snake.

2. If there are small children in the house, buy in a child-resistant container. But for the benefit of the elderly and handicapped, one size of many of these products can be sold in a container without safety packaging.

3. A granular drain cleaner is slightly less hazardous than a liquid drain cleaner.

4. Flexible plastic containers can increase the chance of an injury.

USE

1. Read the entire label carefully before each use and follow instructions exactly.

2. Be sure children are out of the area before using.

3. Protect the skin and eyes as much as possible when using a corrosive.

STORAGE AND DISPOSAL

1. Ideally, corrosive drain cleaners should not be stored in the home at all. Use and discard.

2. If it must be kept-put it in a dry storage area, out of the reach of children, that can be locked.

3. When you discard, it is best to empty the container and rinse it.

FIRST AID TREATMENT

If swallowed - Do not attempt to make the victim vomit.

Give large amounts of water or milk immediately.

Call a doctor or hospital.

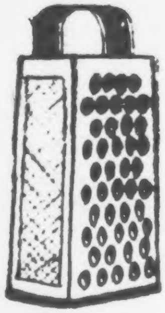
If splashed or lodged in eye - Rinse eye with running water 10-15 minutes.

Call doctor or hospital.

If spilled on skin - Wash with running water 10-15 minutes.

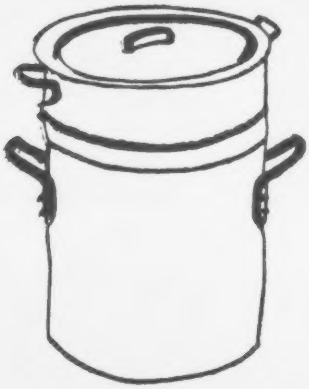
Call a doctor or hospital.

Tools and Utensils: Grater



A metal box with various sized grids used to rub or wear food into small particles.

Tools and Utensils: Double Boiler



Consists of two containers. The bottom resembles a stock pot and holds the boiling water, while the upper part is suspended in the boiling water. It prevents food in the upper part from contact with direct heat. This utensil is used to prepare items that scorch quickly. Commerical double boilers are available in 8 to 40 quart quantity size.

Tools and Utensils: Kitchen Knives

These injuries demonstrate some of the most common causes of knife related accidents.

1. Improper use.
2. Improper storage.
3. Distraction and haste.

Follow these suggestions for knives to prevent hazards.

PURCHASING

1. Buy the size and style of knife appropriate for the kind of cutting you intend to do.
2. Make sure knife is sturdily made.
   - Tang should be at least 1/3 of handle length and preferably the entire handle length.
   - Handle which is riveted to blade in at least two places.
   - Feels comfortable in your hand.
3. Be aware that serrated knives cannot be resharpened without losing their serration.
4. Knife blades with high carbon content discolor more than stainless steel but are easier to resharpen.

USING

1. Always use a cutting board.
2. Take your time while slicing or chopping food.
3. Give it your full attention. Keep your eyes on the knife.
4. Never permit "roughhousing" where knives are in use.
5. When handing to someone, extend handle and turn cutting edge away from your hand.
6. Do not allow children to use knives.
7. Do not attempt to catch falling knives.

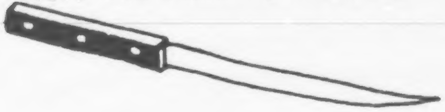
MAINTAINING

1. Wash, dry, and put away immediately after use.
2. Keep knives sharpened.
3. Let family members know when knives have been sharpened.
4. Keep in special rack or block.
5. Do not store large knives in same drawer as flatware.
6. Store knives out of reach of small children.

Tools and Utensils: Knives and Other Sharp Utensils
Safety Rules

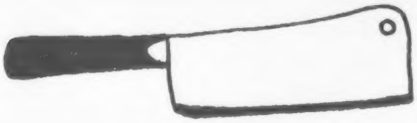
1. Use right knife for the job.
2. Do not grab for a falling knife, jump out of its way.
3. Carry with its tip pointing downward and the cutting edge turned away.
4. Never talk with a knife in your hand.
5. Always cut away from your body.
6. Never place a knife in soapy water, and never reach into soapy water in search of knife.
7. Use a cutting board always.
8. Never cut on metal.
9. Store knives in rack, block, or sectioned drawers.
10. Always use a sharp knife.
11. Use knives only for the purposes for which they were designed.
12. Pick up knives by handle with a firm grip.
13. Do not handle knives if hands are greasy or slippery.
14. When slicing round objects - cut a flat base first.
15. Never open jars or cans with a knife.
16. Wash knives immediately after using and store properly.

Tools and Utensils: Knives



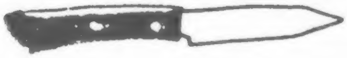
BONING KNIFE: Short, thin knife that is either stiff or flexible with a pointed blade used to remove bone from raw meat with minimal waste, 6-8 inches long.

BUTCHER'S KNIFE: Slightly curved, heavy knife with a pointed blade used in sectioning raw meat.

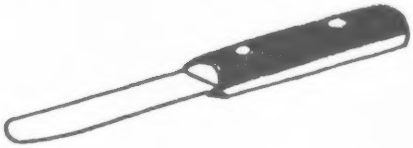


CLEAVER: Extra wide, heavy, square bladed knife used to chop bones.

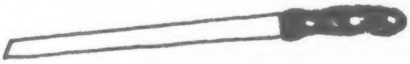
FRENCH KNIFE: Probably the most used of all knives. The blade is wide near the handle and tapers to a point. Its uses include slicing, chopping, mincing and dicing. Blade length may be 8, 10 or 12 inches.



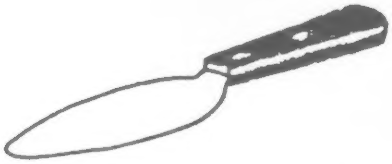
PARING KNIFE: Short, pointed,knife used for paring fruits and vegetables, 2½-3½ inches long.



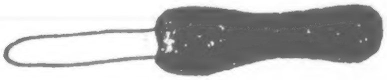
CLAM KNIFE: Short, flat bladed, round-tipped knife used to open clams.



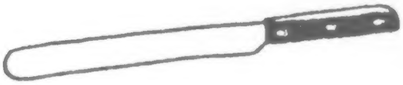
HAM SLICER: Narrow, long and flexible blade. So named because it is used to slice ham, 12 inches long.



PIE OR CAKE KNIFE: Offset knife with a wide, flat blade that tapers to a point. Used to cut and serve pies and cakes.



OYSTER KNIFE: Short, slightly thin, dull-edged knife, with a tapered point. Used to open oysters.

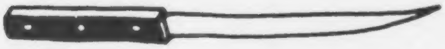


ROAST BEEF SLICER: Round nosed, long bladed knife used to slice any size beef roast, 14 inches long.

KNIFE QUIZ

Name______________________________

Place the knife's correct name in the space provided.



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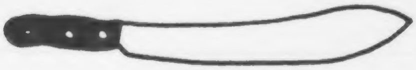

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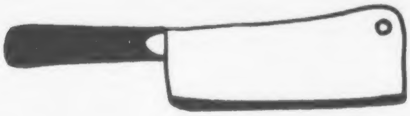

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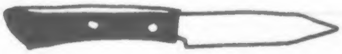

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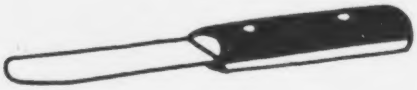

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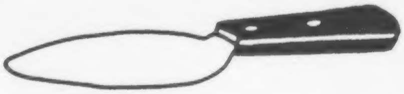

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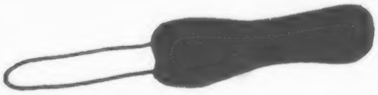

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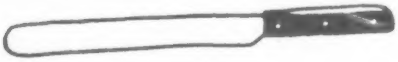

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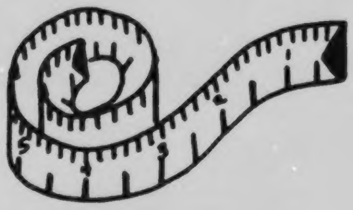
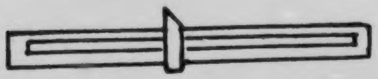
Tools and Utensils: Sewing Tools

FOR MEASURING



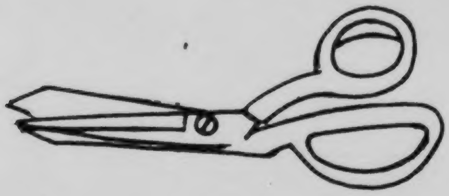
TAPE MEASURE - Usually 60 inches in length with metal ends. A good tape measure will not stretch, and has clearly marked spaces on both sides, starting at opposite ends.



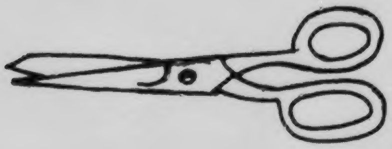
HEM OR SEAM GAUGE - Combines a 4 inch or 6 inch ruler with movable indicator.

FOR CUTTING

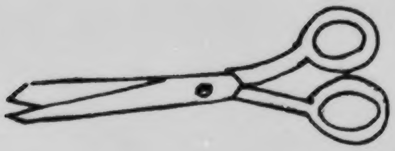
Good scissors and shears make all the difference. Buy the best ones you can afford and treat them carefully and with respect. Keep them sharpened. Do not drop. Do not use on heavy paper or cardboard. Do not use for general household chores.



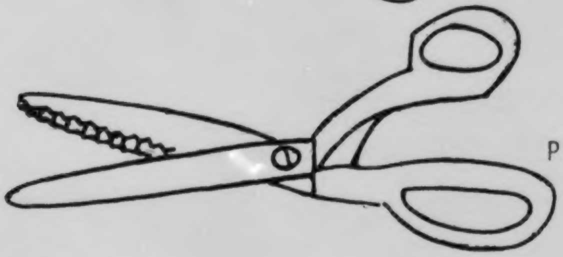
BENT TRIMMERS - For cutting out fabric. The bent handles make for accuracy, as they allow the fabric to remain flat on the table, 7 to 8 inches overall length.



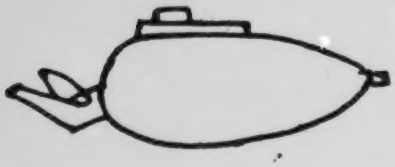
LIGHT TRIMMERS - For general sewing use, trimming seams, clipping threads, etc, 6 to 7 inches overall length.



SEWING OR EMBROIDERY SCISSORS - Have two sharp points for cutting buttonholes, clipping and other fine work, 4 to 5 inches overall length.

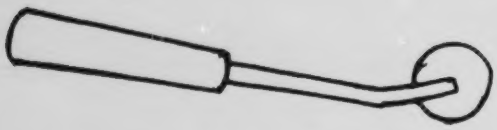


PINKING OR SCALLOPING SHEARS - Used for finishing seams and hem edges, 7½ inches overall length.

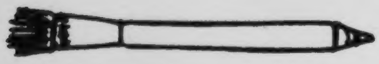


ELECTRIC SCISSORS - Electrically or battery powered scissors. They move as fast as cutter wishes them to.

FOR MARKING

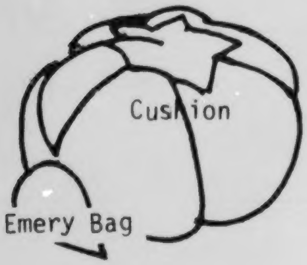


TRACING WHEEL - Used for transferring pattern markings to fabric. Wheels come with or without teeth.



TRACING PENCIL - Also used for transferring pattern markings to fabric. Clay chalk comes in red, white or blue.

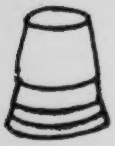
FOR SEWING



PINCUSHION - To avoid scattering pins use a pin cushion.

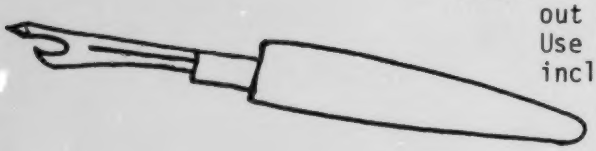
WITH

EMERY BAG - Is usually attached to pincushion and is used to sharpen and remove rust from needles.



THIMBLE - Used for faster and easier hand sewing. Make sure it fits the middle finger of your sewing hand.

SEAM RIPPER - Is a handy tool for taking out seams and removing stitches. Use it carefully to avoid accidents including fabric and personally.

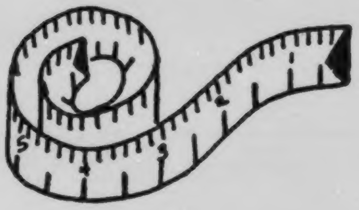


NOTE: Caution should be taken when using sharp and pointed tools. See safety precautions under kitchen knives. Many of these can apply to sewing tools.

SEWING TOOLS AND UTENSILS QUIZ

Name________________________________

Identify each of the following pieces of equipment.



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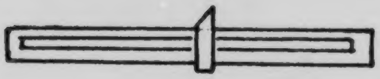

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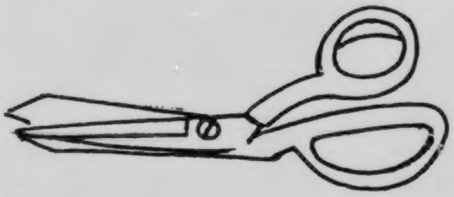

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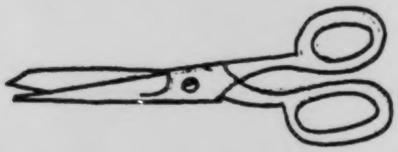

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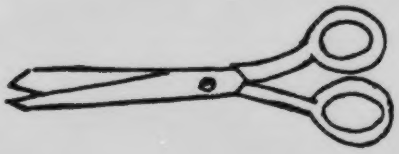

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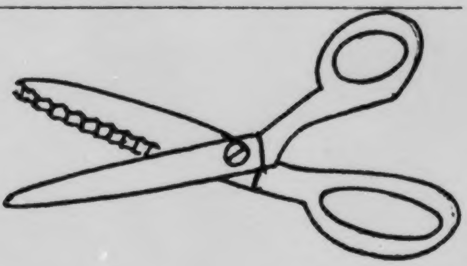

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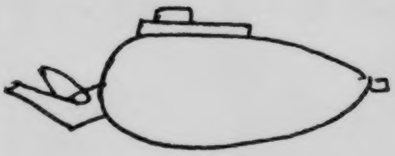

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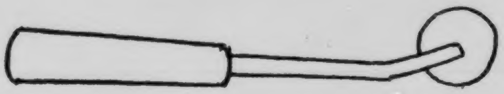

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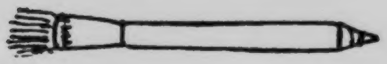
Sewing Tools Quiz continued



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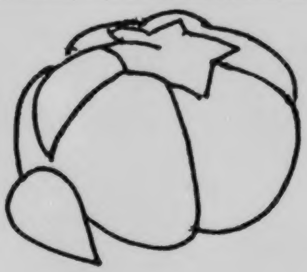

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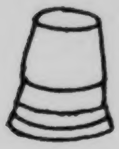

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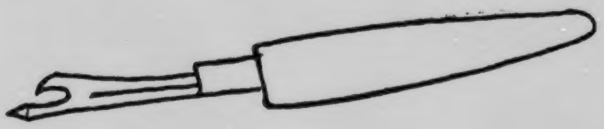

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Hand Held Tools and Utensils: Electrically Operated Toys and Children's Articles

NOTE: Please see Section 5, for more information on toys.

Electrically operated toys and other electrically operated products intended for the use of children can be extremely dangerous. The possible dangers are many:

1. electric shock
2. burns
3. mechanical hazards

Provisions issued in 1973 by Consumer Product Safety Commission are listed below.

MECHANICAL - The product must:

1. Have enclosures which are strong and rigid.
2. Have any potentially hazardous moving parts enclosed or guarded.
3. Have strong handles and knobs that will not crack or break.
4. If it has any pressurized enclosure-they be equipped with an automatic pressure-relief valve that will discharge in the safest possible direction.

ELECTRICAL

1. All live electrical components must be securely enclosed.
2. Switches, motors, transformers, and the like must be securely mounted to prevent any non-functional movement and possible damage.
3. Heating elements must be supported and prevented from making contacts that might produce shock hazards.
4. Products must not be designed for use with water unless the electrical components are contained in a sealed chamber completely separate from water reservoir.
5. Products requiring cleaning with a wet cloth must be designed to prevent seepage of water into electrically active areas.
6. Electrical plugs must have a finger/thumb grasping area and must have a safety shield.

THERMAL

1. Products must not exceed maximum surface temperature requirements.

2. Containers for holding molten compounds and hot liquids must be designed and constructed to minimize spills.

LABELING - Requirements specify that certain precautionary information will be contained in the labels on children's electrical products. It must carry a cautionary message and a minimum age recommendation. Certain areas of the product itself must also be labeled.

1. Accessible surfaces that exceed maximum temperatures.

2. Toys with replaceable electric lights must carry warning of maximum safe wattage for replacement and a notice to disconnect plug before changing the bulb.

3. Non-replaceable lights will be so marked.

4. Products not designed to be immersed in water must carry that notice.

All cautionary statements that appear on the toy or its package must also appear in the toys' instructions.

SELECTING

1. Do not buy any electrical toy for a child too young to use it.

2. Check the age requirement.

3. Take into account the child's capabilities and maturity.

USING

1. Read instructions carefully.

2. Then read the instructions with the child.

3. Make sure child understands completely the safe use of the toy.

4. Keep instructions with the toy where they can be found easily.

5. Supervise the use.

6. Be sure plug fits snugly into wall outlet.
7. Keep infants and toddlers out of area while in use.
8. Store in dry area out of reach of young children.

MAINTAINING

1. Check condition periodically.
2. Be alert to broken parts, frayed cords, and damage to enclosures of wiring, and other protected components.
3. Only an adult should replace light bulbs.
4. If repairs cannot be made, discard toy immediately.

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

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Coat's and Clark, Sewing Book, Newest Methods from A to Z, Western 1967.

Cornelius, Ethelwyn G., Food Service Careers, Bennett, 1974.

Haines, Robert G., Food Preparation For Hotels, Restaurants, and Cafererias, American Technical Society, 1973.

McDermott, Irene E. and Jeanne L. Norris, Opportunities in Clothing, Bennett, 1968.

Mid-America Vocational Curriculum Consortium, Food Service Production and Service, Student Manual, 1976.

"Safety Is No Accident," Student Section, Prepared by District Supervisor, Largo, Florida.

Simplicity Pattern Company, Simplicity Sewing Book Updated, Simplicity Pattern Co, Inc. 1975.

United States Consumer Product Safety Commission, "Drain Cleaners," Fact Sheet No. 72.

United States Consumer Product Safety Commission, "Kitchen Knives," Fact Sheet No. 83.

United States Consumer Product Safety Commission, "Kitchen Safety," Teacher's Guide, No. 5-T.

Washington State Industrial Arts Safety Guide, Prepared by M & M Protection Consultants, Seattle, Washington under direction of Washington State Industrial Arts Safety Guide Steering Committee, 1976.

SCIENTIFIC IMPLEMENTS

PIPETTE

1. Pipetting bulbs should be used when transferring liquid from one container to another. The mouth should never be used because of the possibility of accidental ingestion of the material.
2. The pipette should be plugged with cotton to prevent indiscriminate transfer of material.
3. Pipettes should not be shaken or jarred to prevent the liquid from being splattered.
4. Air must not be bubbled through a pipette.
5. The end of the pipette should be kept below the surface of the liquid when discharging material.
6. If microorganisms are being used, the pipette should be sterilized after each use.

BUNSEN AND ALCOHOL BURNERS

1. The use of bunsen and alcohol burners should be closely supervised by the teacher.
2. All local and state fire and safety regulations must be followed. A fire extinguisher should be present.
3. Burners should be placed on asbestos pads or heat-resistant table tops when in use. They should never be placed on books, papers, or other flammable objects while they are lighted.
4. The pupil must be warned that the flame of an alcohol burner is often very difficult to see.

5. The pupil should be cautioned to:

   A. Wear safety goggles while heating substances.

   B. Keep the work area free of books, papers, clothing, and other flammables.

   C. Avoid leaning or reaching across a lighted burner.

   D. Keep long hair and loose clothing tied back.

   E. Leave a lighted burner in place. It should never be carried from one place to another.

   F. Cap an alcohol burner or extinguish a bunsen burner when it is no longer needed.

6. The rubber hose used to attach bunsen burner gas outlets should be inspected periodically. Dry, cracked hose, or hose with holes must not be used.

7. Preparation for use and storage of alcohol burners should be away from open flames.

8. Burner fuel should be stored in an approved fireproof cabinet that is kept locked.

9. Alcohol burners should never be filled near open flames. A serious fire and/or explosion could occur if the burner fumes should ignite.

10. Alcohol burners should not be filled more than 1/2 to 2/3 full.

11. Matches used to light alcohol burners should be placed in a specially marked, fireproof container.

12. A friction spark lighter is safer to use for lighting bunsen burners than are matches.

13. The pupil should be warned of the dangers of opening laboratory table gas valves when they are not in use.

MISCELLANEOUS TOOLS AND UTENSILS

1. Springs and balls found in certain molecular model sets should never be thrown or left on the floor.

2. The earpieces of stethoscopes should be cleaned with a 70 percent solution of isopropyl alcohol after each use.

COMPRESSED AIR AND COMPRESSED GAS EQUIPMENT

(COMPRESS--TO PRESS OR SQUEEZE TOGETHER; TO CONDENSE.)

COMPRESSED AIR

In the case of compressed air, the above definition could mean pressures in the hundred of pounds. As little pressure as a light wind is capable of propelling items, depending on their weight and density, over rather great distances.

The misuse of compressed air has caused many accidents. It should be limited to running pneumatic tools and other pneumatic equipment, such as air movers, spray guns, and lifts. Under no circumstances should compressed air be used to clean dust from people. Brushes or dust cloths will do a satisfactory cleaning job in most cases involving machines. If a more thorough cleanup job is essential, or where toxic material is involved, a vacuum cleaner should be used. The use of compressed air for cleaning machines blows small particles into the air and creates a serious eye hazard, not only to the operator, but also to anybody in the vicinity.

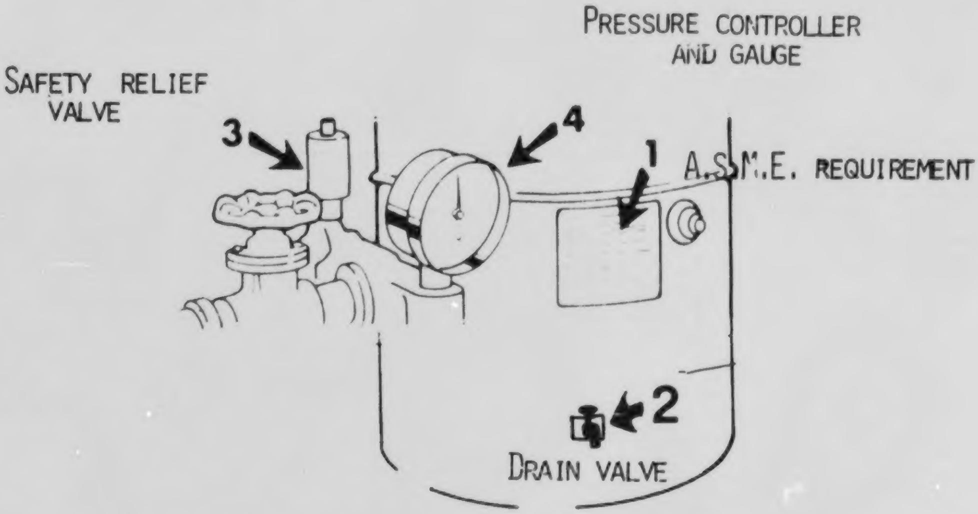
It has been the practice of some workers to blow dirt from their clothes with compressed air. This practice should be strictly prohibited for various reasons:

1. The air could enter body openings, causing severe injury or death; or it could blow out an eye.
2. Compressed air systems are not designed to completely eliminate the carry-over of foreign matter, such as lubricating oil, water, dust, metal particles, and rust. The foreign matter may become imbedded in the skin, causing infection.
3. The dust particles in the clothing may become imbedded in the skin, causing infection.
4. Air, in the form of bubbles, could enter the blood stream through lacerations or abrasions in the skin, causing serious injury, even death.
5. The medical profession uses compressed air as a tool for vaccinating in order to prevent disease. The improper use of compressed air, such as blow drying hand-held parts, can cause the injection (vaccination) of foreign particles into the blood stream; thus causing a serious or even fatal illness.

6. Horseplay with any kind of compressed air device can be as deadly as the improper use of any other DEADLY WEAPON.

AIR COMPRESSOR OPERATION AND MAINTENANCE INSTRUCTIONS

1. New air tanks must be constructed in accordance with the American Society of Mechanical Engineers (A.S.M.E.) Boiler and Pressure Vessel Code, Section VIII. The A.S.M.E. Code requires this information to be permanently stamped on the air tank. (NIOSH)



2. The drain valve on the air tank should be opened frequently to prevent an excessive accumulation of liquid. (NIOSH)

3. Air tanks must be protected by adequate safety-relief valve(s). These valves must be tested at regular intervals to be sure they are in good operating condition. (NIOSH)

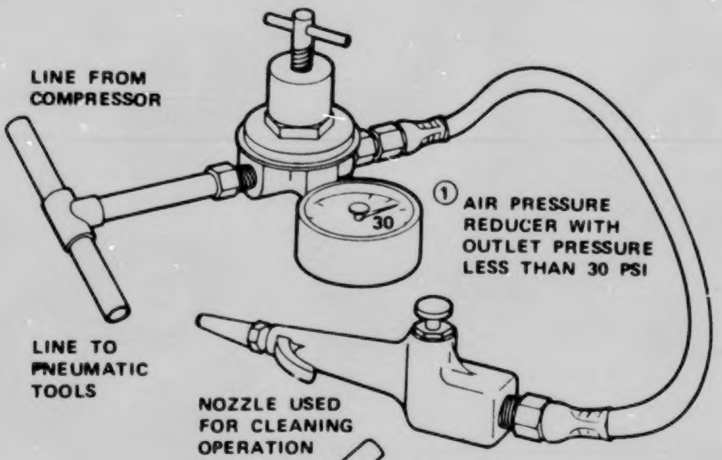
4. The pressure controller and gauge must be maintained in good operating condition. (NIOSH)

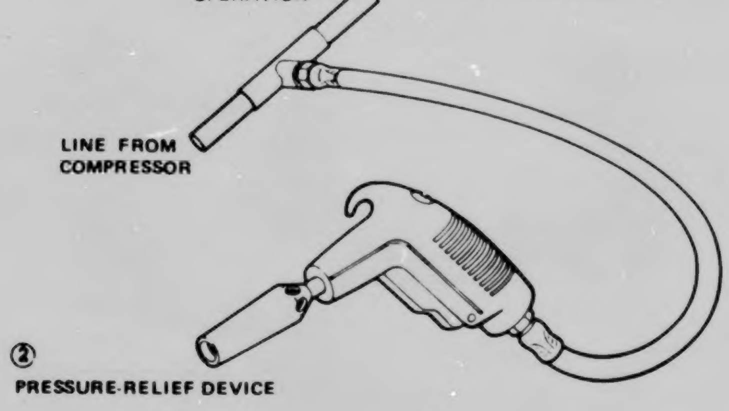
5. There must be no valves between the air tank and safety valve.(NIOSH)

The external moving parts must be supplied with adequate guards, and the unit should be so located that its rather noisy operation will not add to the already existing noise problem of most laboratories. (See Section VI on machine guards and Section XI on Noise Exposure.)

AIR PRESSURE

The downstream pressure of compressed air must remain at a pressure level below 30 psi whenever the nozzle is dead ended and then only when effective chip guarding and personal protective equipment are used. Two acceptable methods of meeting the 30 psi requirement are as illustrated below.

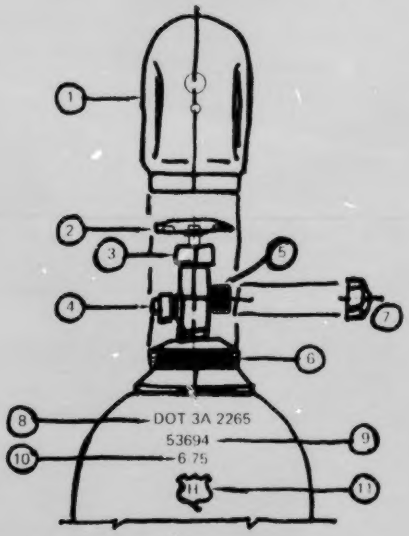

LINE FROM COMPRESSOR
30
① AIR PRESSURE REDUCER WITH OUTLET PRESSURE LESS THAN 30 PSI
LINE TO PNEUMATIC TOOLS
NOZZLE USED FOR CLEANING OPERATION


LINE FROM COMPRESSOR
②
PRESSURE-RELIEF DEVICE

SAFE HANDLING OF COMPRESSED GASES IN LABORATORY AND PLANT

When handled by people who are properly trained and aware of the potential hazards, compressed gases are as safe to work with as most of the ordinary chemical liquids and solids normally handled on a routine basis in any laboratory.

Cylinder safety is ensured by the supplier through his adherence to regulations set forth by the DOT (Department of Transportation). It is mandatory for the supplier to ship cylinders manufactured in conformance with DOT regulations and to follow DOT regulations in the testing and inspection of cylinders, the proper filling of these cylinders, and the use of safety devices which are approved by the Bureau of Explosives.



CYLINDER PARTS AND MARKINGS

Figure 1 shows cylinder parts and important cylinder markings. The cylinder cap (1) protects the cylinder valve. The valve handwheel (2) is used to open and close the cylinder valve. Valves are occasionally not equipped with handwheels, and require special wrenches to effect operation. The valve packing nut (3) contains a packing gland and packing around the stem. It is adjusted only occasionally, and is usually tightened if leakage is observed around the valve stem. It should not be tampered with when used in conjunction with diaphragm-type valves. A safety device (4) permits gas to escape if the temperature gets high enough to endanger the cylinder by increased unsafe pressures. The valve outlet connection (5) connects to the pressure and/or flow-regulating equipment. Various types of connections are provided to prevent interchange of equipment for incompatible gases, usually identified by CGA (Compressed Gas Association) number; for example, CGA No. 350 is used for hydrogen service. A cylinder collar (6) holds the cylinder cap at all times, except when regulating equipment is attached to the cylinder valve. The valve outlet cap (7) protects the valve threads from damage and keeps the outlet clean; it is not used universally.

Specification number (8) signifies that the cylinder conforms to the Department of Transportation specification DOT-3A, governing materials of construction, capacities, and test procedures, and that the service pressure for which the cylinder is designed is 2265 psig at 70° F.

The cylinder serial number is indicated by (9) and (10) indicates the date (month and year; in this case, June, 1975) of initial hydrostatic testing. Thereafter, hydrostatic pressure tests are performed on cylinders, for most gases, every five years, to determine their fitness for further use. At this time, new test dates are stamped into the shoulder of the cylinder. Present regulations permit visual tests in lieu of hydrostatic tests for low-pressure cylinders in certain gases free of corrosive agents. Special permits allow for hydrostatic pressure tests at ten-year intervals for cylinders in high-pressure service for certain gases. The original inspector's insignia for conducting hydrostatic and other required tests to approve the cylinder under DOT specifications is shown by (11).

GENERAL PRECAUTIONS FOR HANDLING AND STORING

1. Never drop cylinders or permit them to strike each other violently.
2. Store cylinders in the open, if necessary. In such cases, they should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground. Cylinders should be stored in the shade in areas where extreme temperatures are not prevalent.
3. Leave the valve protection cap on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.
4. Avoid dragging, rolling, or sliding cylinders; even for a short distance. They should be moved by using a suitable hand truck.
5. Never tamper with the safety devices on valves or cylinders.
6. Do not store full and empty cylinders together. A serious suck back can occur when an empty cylinder is attached to a pressurized system.
7. Do not permit flame to come in contact with any part of a compressed gas cylinder.
8. Do not place cylinders where they may become part of an electric circuit.

INTRAPLANT TRANSPORTATION

When the cylinder is brought to its place of use in the laboratory, it should be secured to a wall, a bench, or some other firm support. A plain chain or a bench clamp and belt should be used. In all cases, make sure that the chain or belt is located high enough on the cylinder body so that the cylinder cannot possibly tumble out of it.

CYLINDER VALVES

The Compressed Gas Association has standardized various outlets for different families of gases to prevent the interchange of regulator equipment between gases which are not compatible. These standards have also been adopted by the American Standards Association. The use of adapters defeats the intent of varying outlet designs, and adapters should be used with care only on gases definitely known to be compatible. Equipment for certain gases, such as oxygen, should never be interchanged for use on other compressed gases. Gases which are oil-pumped can cause an oil film to coat the internal parts of regulators and associated equipment and, if this equipment is then used with oxygen, a fire or explosion is likely to occur.

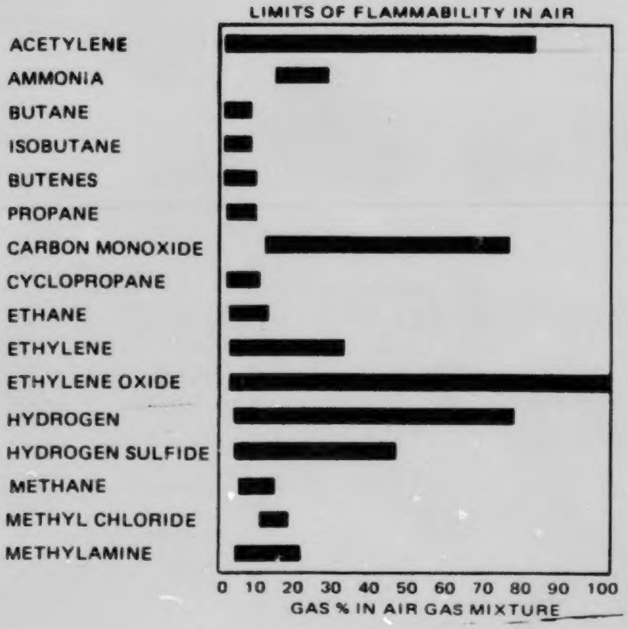
CYLINDER SAFETY DEVICES

Safety devices are incorporated into all DOT approved compressed gas containers, except those in poison or toxic gas service, where the danger of exposure to fumes is considered more hazardous than that of a potential cylinder failure. These safety devices are of four basic types: (1) safety relief--used mostly for low pressure, liquefied, flammable gases; (2) frangible disc--used mostly for high pressure cylinders; (3) frangible disc backed up by a fusible metal--used in high pressure cylinders; and (4) fusible metal.

KNOW THE GAS

It is of the utmost importance that those properties of a compressed gas that represents hazards (such as flammability, toxicity, chemical activity, and corrosive effects) be well known to the user.

FLAMMABLE GASES



The hazards of toxic, flammable, and corrosive gases can be minimized by working in well-ventilated areas.

NONLIQUEFIED GASES--The most common device used to reduce pressure to a safe value for gas removal is a pressure regulator. The regulator should be attached to a cylinder without forcing the threads. If the inlet of a regulator does not fit the cylinder outlet, no effort should be made to try to force the fitting.

The following procedure should be used to obtain the required delivery pressure:

1. After the regulator has been attached to the cylinder valve outlet, turn the delivery pressure adjusting screw counter-clockwise until it turns freely.

2. Open the cylinder valve slowly until the tank gauge on the regulator registers the cylinder pressure. At this point, the cylinder pressure should be checked to see if it is at the expected value. A large error may indicate that the cylinder valve is leaking.

HANDLING OF EMPTY CYLINDERS

Where cylinders are considered empty, the valves should be closed. Valve protection caps, outlet dust caps, and other accessories shipped with the cylinder should be attached to the cylinder as received. The cylinder should be marked or labeled "EMPTY." Cylinders should then be placed in a proper storage area and segregated from full cylinders, to await pickup for return to the supplier.

NEVER TAKE CHANCES

In an emergency, or in conditions creating problems not readily solved, always contact the gas supplier for instructions or information. Do not attempt to handle the situation without further aid.

(Matheson Gas Products, Safe Handling of Compressed Gases in Laboratory and Plant.) Copyright 1974.

SPECIAL NOTE: This section is addressed only to pressure vessels and their handling, and not to their contents. The dangers involved in using specific pressurized gases will be found in the section on Science. The use of acetylene and oxygen is thoroughly covered in the Welding Section.

DESIGN, INSTALLATION, AND OPERATION OF SYSTEMS

DESIGN

Both piping systems and cylinders must be of sufficient strength to safely contain the maximum pressure, plus the recommended safety factor and piping systems of sufficient size to provide the required rate of flow. Safety devices, such as pressure relief valves and fusible plugs, should be properly installed. Discharge piping from the pressure relief valves should be installed so as to discharge into a safe location. These valves must be set to open at a predetermined pressure, and this setting must not be changed. A seal on these valves will insure that the setting has not been altered. These valves must be maintained to insure their proper functioning. It is recommended that remote controls be installed on all key valves, such as filling valves, so that it would be possible to control them in the event of an emergency.

Systems should be kept as simple as possible, with a minimum of joints. All systems should be designed to be as trouble-free as possible, with due consideration for the ease of frequent routine and preventive maintenance. In some cases, such as systems containing chlorine, it is recommended that the joints be flanged or welded, rather than threaded. Care must be taken not to trap the liquid phase of a gas, such as ammonia or chlorine, between two closed valves unless the section is provided with means for expansion. Low spots should be avoided in the design or installation of systems where the material may settle in either the liquid or gaseous state, or where contaminants may settle. All piping and cylinders must be kept away from sources of heat.

The selection of the materials to be used in the systems will depend on what gas is to be handled. The pressures required to handle the gas will dictate the strength that will be necessary, and the chemical properties will dictate the materials to be used. The materials used must be chemically resistive to the gas. For example, ammonia is not only corrosive to copper and copper alloys, and galvanized surfaces, but will also form explosive mixtures with certain substances such as mercury. These metals must, therefore, be avoided, as well as the use of mercury instruments.

For detailed information and advice concerning this subject, the various applicable federal, state, and local regulations, and advisory standards should be consulted. These sources of information include the Interstate Commerce Commission, National Fire Protection Association, Manufacturing Chemists' Association, Inc., and the American Society of Mechanical Engineers.

IDENTIFICATION OF SYSTEMS

Systems should be identified by labeling them with the name of the gas they contain in order to lessen the possibility of selecting the wrong gas. Serious accidents have been attributed to the use of a wrong gas.

One method used to further identify systems is the color-code system (the use of a different color for each gas). The use of color coding is very desirable and not only helps to reduce the possibility of accidents, but also aids in the operation and maintenance of systems. Further, it facilitates tracing out piping systems. Additional aid may also be gained by the use of directional flow arrows.

The use of a color code is not a positive means for preventing the use of the wrong gas. It is a secondary measure which will assist in the proper selection of a gas. It is well to remember, also, that some people are color blind or partially so. Reliance should not be on color coding alone. A suggested code is The USA Standard A13 "Scheme for the Identification of Piping Systems."

A more effective means of preventing accidents of this type would be to install different types of outlets on the various systems so that it would not be possible to interchange them without a great deal of difficulty. This method would make it difficult to connect a compressed air hose to an outlet valve in an oxygen piping system. There are a number of fittings that may be used, such as threaded or snap-lock, right-or left-hand threads, different size fittings, or different thread pitch. (See the Compressed Gas Association code #V-5, Diameter Index Safety System Code for Non-interchangeable Low-pressure Fittings.)

MAINTENANCE

Because these systems contain gases that may be flammable, toxic, corrosive, or otherwise potentially hazardous, and often under very high pressures, it is important that excellent maintenance procedures be established. This is done not only in the interest of economy, but also to prevent a malfunction or failure of the system which could cause a serious accident.

A maintenance program can be separated into two categories. One is routine maintenance, which would be designed to keep areas clean and equipment running. This maintenance would include housekeeping, lubrication of machinery, changing and cleaning filters and strainers, and tightening packing glands. The other type is preventive maintenance, which is responsible for preventing the breakdown of equipment by overhauling it on a predetermined schedule. Maintenance records must be kept, showing the manufacturer's name and address, date of purchase, the name of the equipment, its serial and model numbers, and all other pertinent information as to sizes, capacities, speeds, voltages, amperes, and horsepower on all equipment.

Important facts that these records should show are: the work done, when it was done, and hours of operation. A maintenance schedule based on the manufacturer's recommendations should be established.

For additional information concerning maintenance, refer to Bulletin 246 in the Safety in Industry series, entitled "Maintenance and Safety."

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

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National Institute for Occupational Safety and Health.

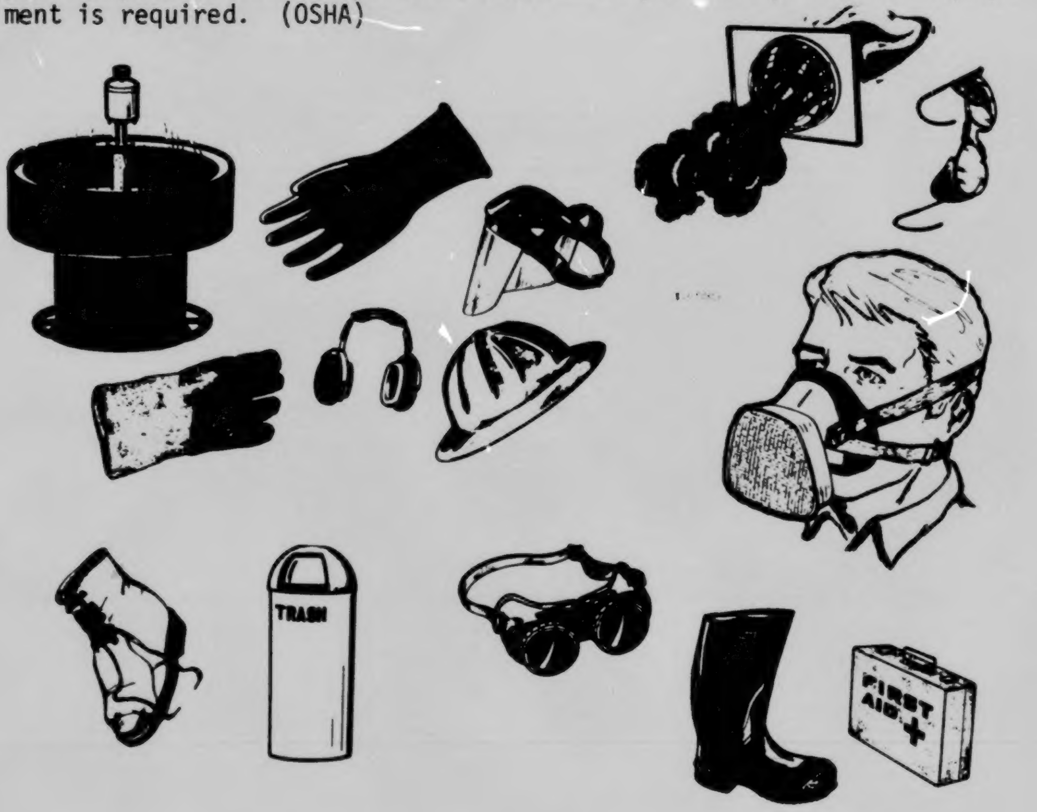
Occupational Safety and Health Administration.

U.S. Department of Labor Bulletin 259.

PERSONAL PROTECTIVE EQUIPMENT

GENERAL REQUIREMENTS FOR PROTECTIVE EQUIPMENT

Employees (pupils) must be adequately protected whenever harmful physical agents or toxic substances are present. It is expected that this protection will be provided through engineering and administrative control systems. However, where such controls are not feasible or only partially installed or operable, individual personal protective equipment is required. (OSHA)



IT IS THE PUPIL'S RESPONSIBILITY TO USE PERSONAL PROTECTIVE EQUIPMENT.

RULES FOR USING PROTECTIVE EQUIPMENT(OSHA/NIOSH)

1. The teacher/employer is responsible for requiring the pupil/employee to wear appropriate personal protective equipment where operational hazards exist.

2. It is the teacher's/employer's responsibility to instruct the pupil/employee in the recognition and avoidance of work-related hazards and the proper use of protective equipment.

3. Pupils/employees shall not be subjected to contaminated air without the use of proper protective equipment (see Threshold Limit Values of Airborne Contaminants for 1970).

4. Safety shoes shall be worn where heavy equipment is handled.

5. Persons who may become wet as a result of their work must be provided with aprons, coats, jackets, sleeves, or other garments for protection.

6. Protection against noise shall be provided if the sound exceeds 90 decibels for eight hours per day, 94 decibels for four hours per day, 100 decibels for 2 hours, or 105 decibels for one hour. Peak sound should not reach 140 decibels unless adequate protection has been provided.

7. If pupils/employees provide their own protective equipment the teacher/employer is responsible for its adequacy, including maintenance and sanitation.

8. Loose clothing that may become entangled in machinery shall not be worn where this type hazard exists; i.e., ties, tails, torn clothing, etc.

9. Wrist watches, rings, or other jewelry shall not be worn where they constitute a danger.

10. Long hair must be confined by cap, hat, hairnet, or other restraint when one is working around equipment with moving parts.

11. Whenever protective equipment is provided by the teacher/employer it shall be the duty of each pupil/employee to use the equipment.

12. One should avoid inhaling fumes from brass, zinc-galvanized iron, or lead paint.

EYE AND FACE PROTECTION

The eye is protected from impact by the bony socket in which it rests. This socket intercepts large objects before they reach the surface of the eye. Tears provide lubrication for the eyelids and wash foreign material from the surface of the eye. The eyelids close to protect the surface of the eye from damage by small objects. The fatty tissue lining in the bony socket cushions the eye against shock. Despite these protective features, the eye is easily damaged.

The eye is a complex, specialized organ which does not recover from injury as other tissue does. The eye possesses few blood vessels. Consequently, injuries are much slower to heal, and the eye may never fully recover.

Airborne particles are a constant danger to the eye. Particles can lodge on the surface of the eye, causing severe discomfort. If they travel with sufficient force they can penetrate deep into the eye. They are then extremely difficult to remove and often cause permanent damage or loss of vision. In addition, another type of danger exists. Pure copper and iron particles lodged in the eye can result in the loss of sight because of their toxic effects on the tissue.

FIRST AID FOR EYE EMERGENCIES--ALWAYS CONTACT THE SCHOOL NURSE

SPECK IN THE EYE

1. Lift the upper eyelid outward and down over the lower lid and attempt to roll the eyes upward. Pull the lower lid forward and down.

2. Let tears wash out the speck or particle.

3. If the particle doesn't wash out, one should keep the eye closed, bandage it lightly, and see a doctor.

4. Do not rub the eye.

BLOW TO THE EYE

1. Apply cold compresses immediately for 15 minutes. Repeat each hour, as needed, to reduce pain and swelling.

2. In case of discoloration or "black eye" (internal damage to the eye), see a doctor.

CUTS AND PUNCTURES OF THE EYE OR EYELID

1. Bandage the eye lightly and see a doctor at once.

CUTS AND PUNCTURES OF THE EYE OR EYELID--CONTINUED

2. Wash the eye with water

3. Try to remove an object which is stuck in the eye.

CHEMICAL BURNS--Eye damage from chemical burns may be extremely serious, especially from alkalis or caustic acids. The damage may be less severe if it comes from chemical irritants. In all cases of eye contact with chemicals use procedure listed below:

1. Flood the eye with water immediately, continuously, and gently, for at least 15 minutes. Hold the head under the faucet or pour water into the eye, using any clean container. Keep the eye open as widely as possible during flooding.

2. Use an eye cup

3. Bandage the eye.

CAUTION: Spray cans are an increasing source of chemical eye injury, compounded by the force of contact.

EYE PROTECTION AND THE LAW

K.S.A. 72-5207. EYE PROTECTIVE DEVICES REQUIRED WHEN PARTICIPATING IN CERTAIN COURSES. Every pupil and teacher in all schools, colleges, and universities or other educational institutions participating in any of the following courses:

(A) VOCATIONAL, TECHNICAL, or INDUSTRIAL ARTS shops or laboratories involving experience with:

1. Hot, molten metals, or other molten materials;
2. Milling, sawing, turning, shaping, cutting, grinding; or stamping of any solid materials;
3. Heat treatment, tempering, or kiln firing of any metal or other materials;
4. Gas or electric arc welding, or other forms of welding processes;
5. Repair or servicing of any vehicle;
6. Caustic or explosive materials.

4. In no instance shall contact lenses be considered as eye protection. If they are worn (and this is not recommended) appropriate covering safety eyewear shall also be worn.

5. Protectors shall meet the following requirements:

   A. Adequately protect against named hazard(s). (They must bear appropriate ANSI standards markings.)

   B. Be reasonably comfortable.

   C. Fit snugly and not interfere with normal movements.

   D. Be durable.

   E. Be capable of being disinfected.

   F. Be easily cleanable.

6. Protectors shall be kept clean and in good repair.

7. Eye protection must be provided from flying objects, direct or reflected brightness (glare), hazardous liquids, injurious radiation, or a combination of these hazards. Where feasible, clear lenses are preferred to tinted or absorptive lenses because of the improved vision, unless radiation or glare hazards exist.

8. Persons who must wear corrective spectacles shall wear either corrective (Rx) safety spectacles or goggles over their corrective spectacles; or wear a goggle that incorporates corrective (Rx) lenses mounted behind the protective lenses.

9. Protectors must be marked according to the manufacturer as well as bearing the 787 logo.

10. Eye and face protective devices manufactured prior to current ANSI standards shall be allowed to continue in service throughout their useful life.

11. The users of protective equipment must abide by the manufacturer's designations for its proper use and limitations as well as by the stated precautions.

12. Design, construction, testing, and use of devices for eye and face protection shall be in accordance with Anerican National Standards for Occupational and Educational Eye and Face Protection Z87.1-1968 or later standards (amended 1979).

NOTE: The occupational Safety and Health Act of 1970 was signed into law by President Nixon on December 29, 1970, effective April 28, 1971 Ammerdments effective July 1, 1978.

(B) CHEMICAL OR COMBINED CHEMICAL-PHYSICAL LABORATORIES involving caustic or explosive chemicals or hot liquids or solids, or injurious radiations, or other hazards not enumerated; is required to wear appropriate industrial quality eye protective devices at all times while participating in such courses or laboratories. Such devices may be furnished for all pupils and teachers, and shall be furnished for all visitors to such classrooms and laboratories. Such devices may be purchased in large quantities and sold at cost to pupils and teachers.

"Industrial quality eye protective devices," as used in this section, means devices meeting the standards of the United States of American standard practice for occupational and educational eye and face protection, Z87.1-1968, promulgated by the American National Standards Institute, Inc.

The provisions of this section shall apply to industrial quality eye protective devices purchased or otherwise obtained for use after the effective date of this act, and shall not have retroactive application to disqualify any such device in use on or before the effective date of this act.

EYE PROTECTIVE DEVICES

The law requires that such eyewear meet the United States of American Standard Practice for Occupational and Educational Eye and Face Protection, (K.S.A. 72-5207) Z87.1-1968. This new standard applies only to eye protective devices purchased after July 1, 1978. However, since its enactment, ANSI Standards have been updated to Z87.1-1979.

COMPLIANCE WITH THE LAW

Each educational unit shall accept responsibility for compliance with K.S.A.-72-5207. An administrator or said designee shall establish and administrate the safety program and coordinate its incipience and continuence. Annual staff orientations shall be held as well as routine inspections of hazardous areas.

REGULATIONS GOVERNING EYE PROTECTION (OSHA/NIOSH)

1. Eye and face protection shall be worn in hazardous environments.

2. No unprotected person shall knowingly be subjected to hazardous environments.

3. Educational institutions or employers shall make available a type of protector that is suitable to the work to be performed and see that employees or pupils shall use such protectors.

CARE AND DISINFECTION OF EYE PROTECTORS

Regular cleaning of protective devices is essential; once daily is recommended. The lenses should be cleaned with warm water and soap or a commercial solution, and then be wiped dry.

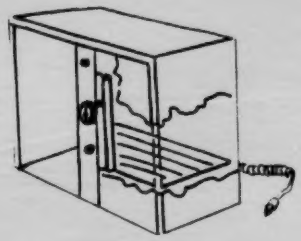
Pitted lenses can be a source of reduced vision. They should be replaced. Deep scratches may even reduce the strength of the lens. The molded-type plastic frames lend themselves readily to lens replacement. Spectacle-type glass lens require professional skill to replace. In these cases, consideration should be given to replacing the entire safety device.

Keeping spectacles or goggles in their cases will greatly extend their usability. The plastic bag or box in which they come is an ideal dust-proof container for this purpose.

When protective devices are worn by more than one person, frequent disinfection is required. The device should be thoroughly cleaned with soap and water and dried with a tissue. Next, the safety device should be completely immersed in a disinfecting solution for ten minutes. Then it can be removed and dried at room temperature. Never wipe it dry as this will remove the residual disinfectant and lessen its effectiveness. Ultraviolet disinfecting equipment may be utilized. However, it may cause deterioration of the rubber parts.

SANITIZATION CABINET

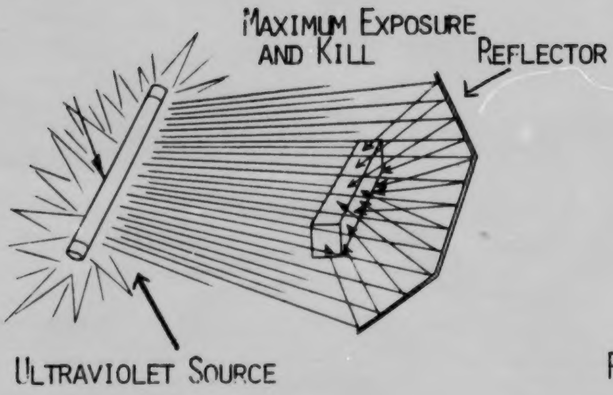
Manufacturers claim that these cabinets kill all types of micro-organisms and are excellent for goggles, spectacles, and various types of head sets.

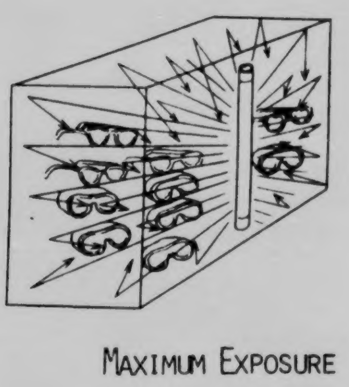


LONG LIFE: 7500 HRS.
GERMICIDAL TUBE

(ULTRAVIOLET LIGHT)

GERMICON





CONTACT LENSES

In the educational setting, as in employment, there is much discussion about the efficacy of contact lenses. The following is quoted verbatim from safety bulletin, number 90, Wichita Electrical JATC:

> "A man was wearing safety glasses over his contact lenses when he opened a 440-volt box to connect a welding cable. When the circuit breaker was opened, the breaker arched and a flash occurred. Later, when the man tried to remove his contact lenses, large amounts of dried cornea came off with each lens."
>
> "The contacts evidently served to concentrate the heat of the arc flash on the cornea of the eye."

Following is a position statement offered by the National Society to Prevent Blindness:

> "Because of increased risk to the eyes, the National Society to Prevent Blindness strongly advises that the use of contact lenses of any type by industrial employees while at work should be prohibited, except in rare cases. The National Society recommends that any exceptions be verified in writing to the employer by the physician or optometrist who sanctions such use in a specific industrial environment. Contact lenses which do not provide eye protection devices of industrial quality should not be permitted."

HE WAS WEARING CONTACT LENSES WHEN . . . . .

Phototropic Lenses

The "Connecticut Eye Safety Manual for Education," March 1979 states that phototropic lenses do not fully comply with ANSI Z87.1-1979, indoor light transmission requirements....they should not be worn anywhere that hazardous ultraviolet or infrared radiation could be encountered. No variable or fixed-tint lenses should be worn indoors unless called for by the nature of the particular task, or when prescribed for individuals by ophthalmic specialists.

Shades of Lenses

Though there are many shades of lenses made in accordance with federal specifications, the most commonly used are light, medium, or dark green. The light green shade transmits about 18.1% of infrared rays and 1% of ultraviolet rays. The medium shade transmits 51.6% of noninjurious visible rays, but eliminates completely ultraviolet rays and reduces infrared rays to 7.7%. The dark green lens transmits only 31.3% of the noninjurious rays, but reduces infrared rays to 1.7%.

Six shades of cobalt blue lenses are available for smelters and furnace workers. Didymium lenses are available when conditions of bright yellow glare are present. These lenses are pink in color and are not to be used when injurious rays are present. When light-reflected glass is a problem, amber lenses are available. However, these too should not be used if harmful rays are present.

Welding: Selection of Correct Filter

Because of the importance of adequate eye and face protection for welders and those associated with welding, the following information is provided here, as well as in the welding section of the safety manual.

SELECTION OF SHADE NUMBER FOR WELDING FILTERS **

WELDING OPERATION	SUGGESTED SHADE NUMBER*
Shielded Metal-Arc Welding, up to 5/32 in (4MM) electrodes	10
Shielded Metal-Arc Welding, 3/16 to 1/4 in (4.8 to 6.4 mm) electrodes	12
Shielded Metal-Arc Welding, over 1/4 in(6.4 mm) electrodes	14
Gas Metal-Arc Welding (Nonferrous)	11
Gas Metal-Arc Welding (Ferrous)	12
Gas Tungsten-Arc Welding	12
Atomic Hydrogen Welding	12
Carbon Arc Welding	14
Torch Soldering	2
Torch Brazing	3 or 4
Light Cutting, up to 1 in (25 mm)	3 or 4
Medium Cutting, 1 to 6 in (25 to 150mm)	4 or 5
Heavy Cutting, over 6 in (150mm)	5 or 6
Gas Welding (Light) up to 1/8 in (3.2 mm)	4 or 5
Gas Welding (Medium) 1/8 in to 1/2 in(3.2 to 12.7mm)	5 or 6
Gas Welding (Heavy) over 1/2in (12.7mm)	6 or 8

*The choice of a filter shade may be made on the basis of visual acuity and may therefore vary widely from one individual to another, particularly under different current densities, materials, and welding processes. However, the degree of protection from radiant energy afforded by the filter plate or lens when chosen to allow visual acuity will still remain in excess of the needs of eye filter protection. Filter plate shades as low as shade 8 have proven suitably radiation-absorbent for protection from the arc-welding processes.

NOTE: In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the operation (spectrum).

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ADDITIONAL WARNINGS

(1) The arc from a welder can cause eye burn even from a distance of 200 feet. (2) Blindness is no more frequent in the welding industry than in any other industry. However, tissue injuries are more prevalent. (3) It has been proven that deep injuries to the eyes of welders can be attributed to short infrared rays.

EYE PROTECTIVE MEASURES -- SAFETY TIPS

1. Wear goggles or a shield when working.
2. Keep the eyes out of the line of work, in case a tool should break.
3. When opening containers of acids or other types of liquids, be sure the face is turned away from the top of the container.
4. In grinding operations, try to keep the face a safe distance from the work area.
5. If one is working with a power tool and the goggles must be removed, be sure the tool is turned off.
6. Never wear cracked, pitted, or damaged goggles or spectacles.
7. Do not engage someone else in conversation while working with power tools.
8. Don't wipe the face and eyes with dirty hands which might have chips or particles clinging to them.
9. If a person feels his/her eyes becoming strained, he/she should stop and relax. Cool, damp cloths applied to the eyelid will help.
10. Keep sharp or pointed objects away from the face.
11. Have the eyes checked regularly.

GENERAL CONCLUSIONS

1. All eye and face protective equipment must meet the current standards of the "American National Standards Practice for Occupational and Educational Eye and Face Protection, Standard Z87.1, 1979."
2. Individuals wearing non-approved personal eyewear must wear cover goggles meeting the ANSI Z87.1-1979 Standard.
3. Eye protectors are a personal item and should not be reissued. If they must be reissued, the proper disinfectant procedures must be followed (see Care and Disinfection of Eye Protectors).
4. Kansas law states that suitable eye protection must be worn where eye hazards exist and where the hazard may be reduced by such protection. (Refer to the chart entitled "Activities Needing Eye Protection" for specific recommendations.) The law identifies the following as hazards:

A. Hot molten metals or other molten materials;

B. Milling, sawing, turning, shaping, cutting, grinding, or stamping of any solid material;

C. Heat treatment, tempering, or kiln firing of any metal or other materials;

D. Gas or electric welding or other forms of welding processes;

E. Repair or servicing of any vehicle;

F. Caustic or explosive materials;

G. Chemical or combined chemical-physical laboratories involving caustic or explosive chemicals, hot liquids or solids, or injurious radiations, or other hazards not enumerated.

5. Eye protection shall be worn by pupils, faculty, visitors, and others participating in, or observing, certain hazardous operations in vocational, technical, industrial arts, and chemical-physical courses or laboratories (see "Activities Needing Eye Protection").

6. Proper-fitting eye protection is imperative! It is strongly suggested that each educational institution assign to a particular individual the responsibility for the selection and disbursement of protective eyewear; including fitting-adjustment techniques. Where this is not possible, and disbursement of such devices is the responsibility of the teacher, inservice training should be provided.

7. Eyewash fountains should be available in every classroom laboratory where chemicals are in use, and showers should be in the immediate area.

TYPES OF EYE PROTECTORS

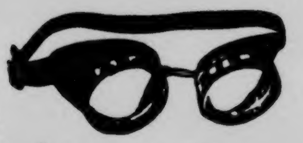
Meeting ANSI Standards

Each eye, face, or face and eye protector is designed for a particular hazard. Only protective eyewear certified by the American National Standards Institute, Inc. may be used (except for visitors). Occasionally, exceptions may be made based on a doctor's recommendation.

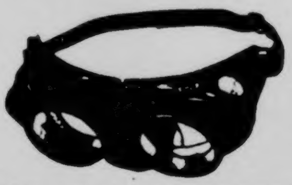
GOGGLES

Goggles are a pair of contour-shaped eyecups of facial contact parts, with glass or plastic lenses worn over the eyes. They are held in place by a headband. There are several types of goggles.

Eyecup Goggles



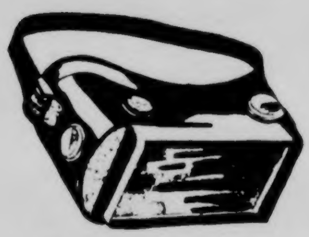
Cup-type goggles-- designed to be worn by individuals who do not wear corrective spectacles.



Cover cup-type goggles-- designed to fit over corrective spectacles.

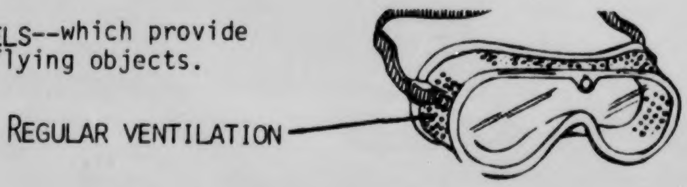
Rigid Cover Goggles

Rigid cover-type-- designed to fit over corrective (Rx) spectacles.

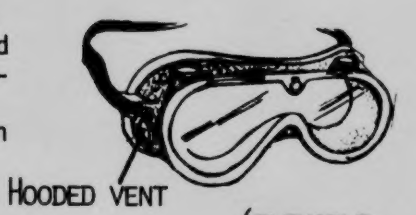


These two basic types (Eyecup Goggles and Rigid Cover Goggles) are further described as:

Chipper's models--which provide protection against flying objects.

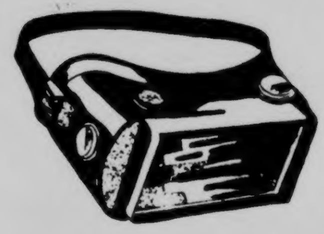


DUST AND SPLASH MODELS--which protect against dust particles, liquid splashes, and impact. They are also commonly called chemical goggles. These goggles have hooded, indirect screen vents to provide ventilation and protection against chemical splash

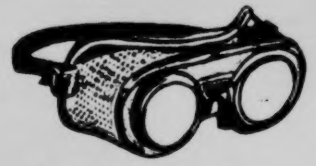


(FLEXIBLE FITTING)

WELDER'S AND CUTTER'S MODELS--These provide protection against glare, injurious radiations, and impact. Welder's goggles are similar to chipper's goggles, except that they are made to contain filter lenses or plates to absorb dangerous amounts of ultraviolet and infrared rays. The shade of filter lenses is indicated by the numbers from 1.5 to 14; the higher the number, the greater the absorptive quality of the lens. (See "Shades of Welding Filters" in this unit.)

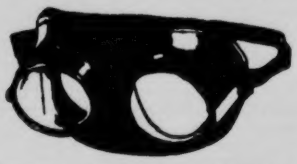


FLEXIBLE-FITTING GOGGLES--A type designed to be worn over corrective spectacles. The frame is composed of a flexible, chemical-resistant, nontoxic, nonirritating, slow-burning material forming a lens holder. They are vented to prevent fogging. Hooded ventilation models protect against fumes, liquids, splashes, mists, spray, and wind. However, because of their flexibility, they offer less protection against impact than do eyecup goggles. They do protect against light flying objects and, when so designed, against glare and injurious radiation. They may be used for light chipping or grinding operations, for use around woodworking machines, for spot welding, and for babbitting. They should not be used for protection against severe flying object hazards or for welding.



FLEXIBLE-FITTING

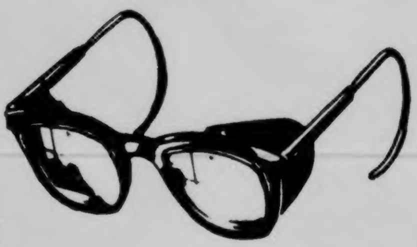
FOUNDRYMEN'S GOGGLES--These are designed to provide protection against impact and the hot metal splash hazards encountered in foundry operations such as melting, pouring, chipping, babbitting, grinding, and riveting. They also protect against dust. This type is similar to those mentioned above except that it has a binding of cordurary or other material over the edge which contacts the face.



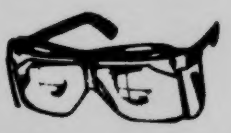
CUSHIONED FITTING, RIGID-BODY, SPLASH PROOF

SAFETY SPECTACLES

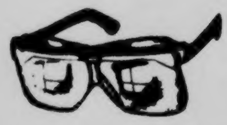
Safety spectacles are patterned after the conventional type of streetwear spectacles but are of vastly superior construction, either with or without side shields. Since side protection as well as frontal protection is necessary, it is required that spectacles have side shields. Lens may be the clear or filter-type, glass or plastic. Corrective safety lenses may be mounted in spectacles as long as they meet ANSI Z87.1-1979 standards. Combinations of streetwear frames with safety lenses are definitely not in compliance.



Metal, plastic, or combination frame spectacles with side shields are intended to provide protection from flying objects and, when required, from glare and injurious radiation. They are recommended for jobs involving light flying objects. They are the most used form of eye protection.



WITH SIDE SHIELD



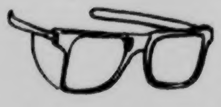
WITHOUT SIDE SHIELD

Plastic eyeshield spectacles are quite similar to the metal-plastic combination mentioned above, and they are used under the same conditions and offer the same protection. However, they are not as durable.

Pupils who require vision correction are encouraged to obtain prescription safety glasses. Where this is not possible, an appropriate cover goggle or suitable protective device should be worn over the regular spectacles.

VISITORS' SPECTACLES

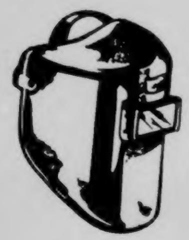
It should be noted that many times visitors' spectacles do not meet ANSI standards and ARE NOT TO BE USED BY PRODUCTION WORKERS (PUPILS).



HELMETS AND SHIELDS

HELMETS AND HAND SHIELDS

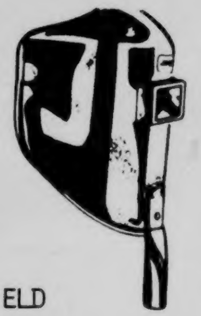
Helmets and hand shields differ from goggles and spectacles in that they are designed to provide protection, not only for the eyes, but the face, ears, and neck. Typical operations involving radiant energy, such as welding or heavy gas cutting, require the protection offered by helmets and hand shields. Because of the area to be protected, the helmet body is of such size and shape as to protect the face, the top of the head, and the neck to a vertical line back of the ears. It has an opening or openings in the front for a filter plate and cover plate. The helmet body is supported by a headgear in such a way that it will not come in contact with any part of the head and can be lifted up from in front of the face so that the welder can examine the weld.



HELMET

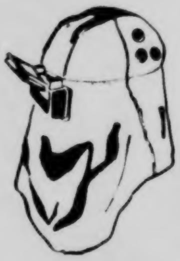
The helmet body is made of vulcanized fiber, reinforced plastic, or other suitable material which is heat and flame resistant. It is also opaque to visible, ultraviolet, and infrared radiations, and capable of disinfection. Rivets or other metal parts, if terminating on the inside surface, are insulated.

HAND SHIELDS are used in some welding operations or for observing the welding process. A handle is used instead of a headgear; the handle being of a material that is a nonconductor of electricity and is noncombustible or slow burning. Hand shields are constructed of materials similar to those used for helmets. The lens mounting arrangement and filter and cover plates are the same as for the helmet.



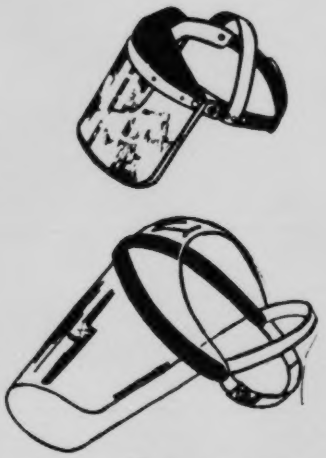
HAND SHIELD

HELMETS may be of nonrigid materials if they are to be used in confined spaces, or may be collapsible for convenience in carrying. These helmets are of the same general shape as the rigid helmet except that a more complete covering of the top of the head is necessary in order to maintain the face, side, and window in the proper position. The requirement for the filter plates, cover plates, and lens-mounting frame are the same as for the rigid helmet.



HELMET OF
NONRIGID MATERIAL

FACE SHIELDS



FACE SHIELDS

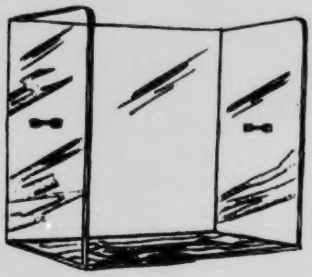
Face shields are designed to give protection to the face (i.e., the front part of the head--including forehead, eyes, cheeks, nose, mouth, and chin) from flying particles and sprays of hazardous liquids and, in addition, to provide anti-glare protection where required.

When face shields are to be used in atmospheres or working areas requiring the special conditions of nonconductivity or nonsparking, then all materials must meet these requirements. Face shields should be plainly and permanently labeled, identifying them as "nonconductive" or "nonsparking."

Some typical uses for face shields are woodworking operations where chips and particles fly; metal machining causing flying particles; buffing, polishing, wire brushing, and grinding operations where flying particles or objects may strike the face; spot welding; and the handling of hot or corrosive materials. They are not acceptable as protection against heavy flying objects, for welding, cutting, or intense radiant energy. In these cases, appropriate goggles or helmets should be worn. In foundry operations where molten metal is being handled, a plastic face shield must be worn.

DEMONSTRATION SAFETY SHIELDS

Performing certain kinds of demonstrations (i.e., a chemistry experiment) may require the use of a safety shield, and it may be used in lieu of individual eye protection for observers, but not for participants. Safety shields are an adjunct to safety eyewear, not a substitute.



DEMONSTRATION SAFETY SHIELD

EYE PROTECTION ACTIVITY AREAS

The following table indicates the recommended eye protection devices for various activity areas and the related hazards.

OPERATION OR ACTIVITY AREA	EYE HAZARDS	EYE PROTECTION DEVICES
Auto Mechanics		
Welding, electric arc	Welding flashes, flying sparks	Welding helmet
Gas welding, cutting, and burning	Hot metal splatters	Welding goggles
Cleaning overhead	Flying dusts, splashes	Chemical goggles
Grinding and other work	Flying chips, dusts, splashes	Safety spectacles with full side shields Chemical goggles Face shield**
Administration	The same eye protection devices as prescribed for students in various areas of activity are required for administrative personnel	
Carpentry Tool grinding, joiner, planer, sander, shaper, cleaning, and other work	Flying chips, dusts, splashes	Safety spectacles with full side shields Chemical goggles Face shield**
Chipping Cold chisel, drill press, grinding, metal sanding, milling, pressure greasing, shaping, machine spray painting, steam cleaning	Flying chips, dusts, splashes	Safety spectacles with full side shields Chemical goggles Face shield**
Commercial Art Spray painting and other work	Sprays	Safety spectacles with full side shields
Commercial Food Cooking	Flying hot greases	Safety spectacles with full side shields
Ceramics Kiln inspection during firing and unloading, potters wheel, spraying glaze	Air bubble explosion, flying clay, clay particles, fluids	Safety spectacles with full side shields Face shield**
Copper Enameling Enameling, kiln firing	Air bubble explosions, flying dust particles, enamel chips	Safety spectacles with full side shields Face shield**
Electric Shop Grinding and other work	Flying borings, chips, dusts	Safety spectacles with full side shields
Electricity/Electronics Drilling, hand and machine boring, metal lathe turning, hand and machine punching, soldering, spring winding, tube handling, wire stripping	Flying metals and wood chips, glass, wire spring, splattering solder	Safety spectacles with full side shields
Foundry Work Chipping and filing castings, sand packing a flask	Flying chips, sand, parting compounds	Safety spectacles with full side shields Face shield**
Heating and pouring metal	Splashing and sputtering molten metals	Face shield**
General Metals **(Sheet, Art, and Bench Metal)** Annealing, bending and shaping metals, butting, chiseling metals, drill press, etching, metal spinning, pickling of metals, riveting, sawing metals, snipping metals, soldering, tinning a copper	Flying chips, chunks, projectiles, lubricants, lint, buffing compounds, sparks, abrasives, rivets, sputtering solder, flux, splashing acids, fluids	Safety spectacles with full side shields
Graphic Arts Darkroom chemicals, knives for cutting silk screen, offset press wire stitcher	Chemical splashes, flying metals, improper handling of knives	Safety spectacles with full side shields
Home Economics Cooking	Flying hot greases	Safety spectacles with full side shields
Instruction	The same eye protection devices as prescribed for students in various areas of activity are required for institutional personnel	

** Must be worn over primary protective device.

*Delaware Department of Instruction

OPERATION OR ACTIVITY AREA	EYE HAZARDS	EYE PROTECTION DEVICES
Jewelry Work		
Silver soldering, chasing, forging, bending, casting, sawing and pickling	Sputtering metals, flux, flying chips, wire ends, broken saw blades, acid splashes	Safety spectacles with full side shields Chemical goggles
Lasers	See Appendix A	
Leather Carving		
Carving, stamping	Flying chips	Safety spectacles
Mosaic Tile Work		
Cutting tile	Flying chips	Safety spectacles with full side shields
Machine Shop		
Cylindrical grinder, surface grinder, grinders, lathe milling machine, shaper, and other work	Flying chips, dusts, shavings, splashes	Safety spectacles with full side shields Chemical goggles Face shield**
Bench grinder, chipping, filing and scraping, drill press, lathe milling machine, power hacksaw, shaper, surface grinder	Flying abrasive chips, cuttings, cutter teeth, broken cutters, piece being machined, sparks, splashing cutting fluids	Safety spectacles with full side shields Chemical goggles Face shield**
Metallurgy Lab		
Lead pot, heat treating and salt bath furnaces	Flying hot metals, hot molten splashes	Chemical goggles Face shield**
Grinders, polishing, tensile tester, and other work	Flying dusts and particles, splashes	Safety spectacles with full side shields Chemical goggles Face shield**
Maintenance and Custodial	Flying objects, splashes of corrosive liquids, dusts	Chemical goggles
Plastics Area		
Buffing machine, carving, drill press, extruding heat, forming, portable drills, sanding, sawing, shaping machine	Flying broken drills, plastic chips, compound plastic dusts, splattering broken parts	Safety spectacles with full side shields
Plumbing, Pipefitting, Welding		
Welding, electric arc	Welding flashes, sparks	Welding hood
Gas welding, cutting and burning	Hot metal splatters	Welding goggles
Pressure testing	Flying metal, splashes	Chemical goggles Face shield**
Grinding and other work	Flying dusts	Safety spectacles with full side shields Chemical goggles Face shield**
Printing		
Melting lead and other work	Ink splatter, flying dusts, solvents	Safety spectacles with full side shields
Radio and Television		
Buffing, grinding, soldering, and other work	Flying chips, dusts, flux, loose wires	Safety spectacles with full side shields
Science Laboratories		
(Life, physical, earth science areas and science activities, K-12)	Chemical storage or handling	Safety spectacles with full side shields
	Any activity or operation that is potentially dangerous to the eye	Chemical goggles Face shield**
Visitors	Visitors must wear eye protection devices as required for the activity in the area visited.	
Welding		
Welding, electric arc	Welding, flashes, flying sparks, flux, sputtering welds, air bubble explosions	Welding helmet
Gas welding, cutting and burning	Flying sparks, metals, flux	Welding goggles
Chipping welds	Flying chips, slag	Face shield**
Other work	Flying chips, sparks	Safety spectacles with full side shields
Wire Work		
Shaping and forming	Moving unprotected ends	Safety spectacles with full side shields

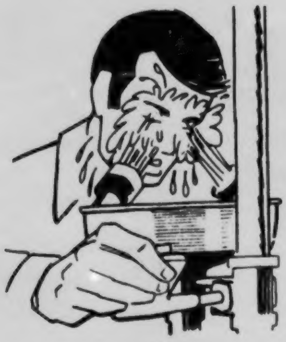
** Must be worn over primary protective device.

EYEWASH FOUNTAINS

An eyewash station is a permanently installed basin which has twin streams of water to gently wash the two eyes. The valve may be operated by hand or foot or by pushing a bar with the head.

Despite all the generally used protective measures, accidents still occur. Access to an eyewash basin is imperative when corrosive chemicals enter the eyes. The first 15 to 30 seconds are critical with an alkali splash.

EMERGENCY EYEWASH FOUNTAIN. Chemicals splashed in the eyes may cause permanent injury if not removed IMMEDIATELY.



Don't wait to finish the job when an eye splash occurs. Use an eye wash fountain or other source of clean running water IMMEDIATELY, and keep using it for 15 minutes.

Also useful is a five foot length of 1/2 inch rubber hose with an aerated nozzle. The victim can lie down and have another person hold the eye open while washing it.

Eyewash stations utilizing boric acid or other buffer solution as a protective agent are of doubtful value. First, they contain too little liquid; and second, water alone is best.

SHOWERS (OSHA/NIOSH)

If contamination occurs on the clothing or skin, a person should be immediately rushed to the safety showers. The contaminated clothing should be removed in the shower and the one contaminated should remain there for ten minutes. Always get medical aid if the skin is damaged or remains red; if the person feels like vomiting; or if he/she has vision or breathing problems. Never put on clothing that has been contaminated until it has been laundered or cleaned.

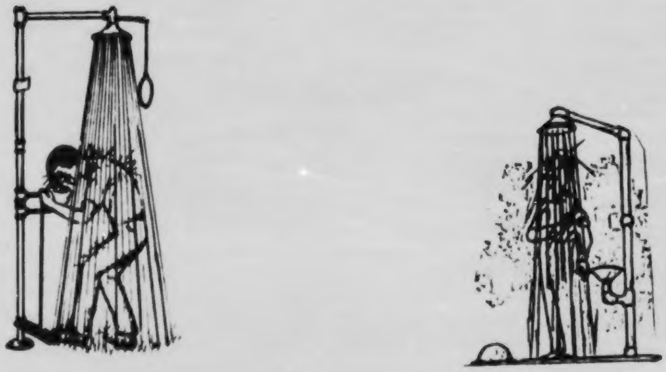
Suitable facilities for the quick drenching or flushing of the eyes and body must be provided within the work area where a person may be exposed to corrosive material.

One shower shall be provided for each ten employees of each sex, or numerical fraction thereof, who are required to shower during the same shift.

Body soap or other appropriate cleansing agents, convenient to the showers, shall be provided.

Showers shall be provided with hot and cold water, feeding a common discharge line.

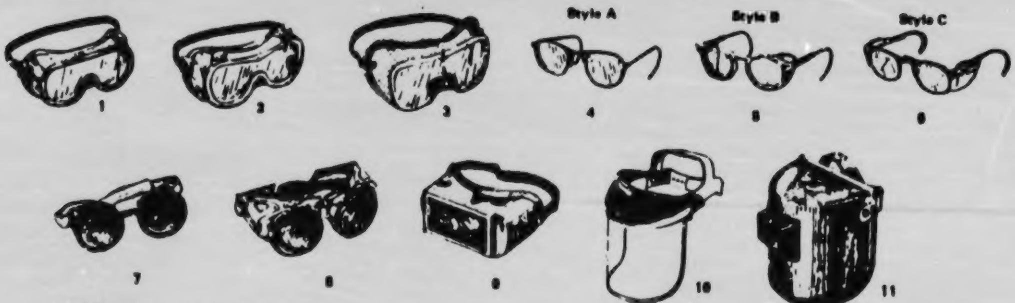
Employees who use showers shall be provided with individual clean towels.



REMOVE CLOTHING AFTER GETTING UNDER THE SHOWER.

Selection Chart for Eye and Face Protectors for Use in Industry, Schools, and Colleges

This Selection Chart offers general recommendations only. Final selection of eye and face protective devices is the responsibility of management and safety specialists. (For laser protection, refer to American National Standard for Safe Use of Lasers, ANSI Z136.1-1976.)



1. GOGGLES, Flexible Fitting, Regular Ventilation
2. GOGGLES, Flexible Fitting, Hooded Ventilation
3. GOGGLES, Cushioned Fitting, Rigid Body
*4. SPECTACLES, without Sideshields
5. SPECTACLES, Eyecup Type Sideshields
6. SPECTACLES, Semi-/Flat Fold Sideshields
**7. WELDING GOGGLES, Eyecup Type, Tinted Lenses (Illustrated)
7A. CHIPPING GOGGLES, Eyecup Type, Clear Safety Lenses (Not Illustrated)
**8. WELDING GOGGLES, Coverspec Type, Tinted Lenses (Illustrated)
8A. CHIPPING GOGGLES, Coverspec Type, Clear Safety Lenses (Not Illustrated)
**9. WELDING GOGGLES, Coverspec Type, Tinted Plate Lens
10. FACE SHIELD, Plastic or Mesh Window (see caution note)
* 11. WELDING HELMET

*Non-sideshield spectacles are available for limited hazard use requiring only frontal protection.
**See Table A1, "Selection of Shade Numbers for Welding Filters," in Section A2 of the Appendix.

APPLICATIONS

OPERATION	HAZARDS	PROTECTORS
ACETYLENE—BURNING ACETYLENE—CUTTING ACETYLENE—WELDING	SPARKS, HARMFUL RAYS, MOLTEN METAL, FLYING PARTICLES	7, 8, 9
CHEMICAL HANDLING	SPLASH, ACID BURNS, FUMES	2 (For severe exposure add 10)
CHIPPING	FLYING PARTICLES	1, 3, 4, 5, 6, 7A, 8A
ELECTRIC (ARC) WELDING	SPARKS, INTENSE RAYS, MOLTEN METAL	11 (In combination with 4, 5, 6, in tinted lenses, advisable)
FURNACE OPERATIONS	GLARE, HEAT, MOLTEN METAL	7, 8, 9 (For severe exposure add 10)
GRINDING—LIGHT	FLYING PARTICLES	1, 3, 5, 6 (For severe exposure add 10)
GRINDING—HEAVY	FLYING PARTICLES	1, 3, 7A, 8A (For severe exposure add 10)
LABORATORY	CHEMICAL SPLASH, GLASS BREAKAGE	2 (10 when in combination with 5, 6)
MACHINING	FLYING PARTICLES	1, 3, 5, 6 (For severe exposure add 10)
MOLTEN METALS	HEAT, GLARE, SPARKS, SPLASH	7, 8 (10 in combination with 5, 6, in tinted lenses)
SPOT WELDING	FLYING PARTICLES, SPARKS	1, 3, 4, 5, 6 (Tinted lenses advisable, for severe exposure add 10)

CAUTION:
- Face shields alone do not provide adequate protection.
- Plastic lenses are advised for protection against molten metal splash.
- Contact lenses, of themselves, do not provide eye protection in the industrial sense and shall not be worn in a hazardous environment without appropriate covering safety eyewear.

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Eye Safety Quiz *

Name_______________________________

Class_______________________________

Date_______________ Grade_____________

(Circle true or false)

1. If the eye shield is in place on a bench or pedestal grinder, it is not necessary to wear goggles. T F
2. Goggles are not worn by the lathe operator because they hinder the vision of the operator. T F
3. Goggles should be worn around any machine that may produce flying chips or particles. T F
4. The tinted lens in a welding helmet is approximately the same shade as the lens in a pair of sun glasses. T F
5. One should wear some type of eye protection when using a spray painting machine. T F
6. One should wear goggles or a face shield when cleaning dirty machines or parts with compressed air or steam. T F
7. Goggles or face shields should never be worn while handling or pouring molten metal due to the fact that they may become fogged over from the intense heat. T F
8. The wood chips flying from the machines in a woodworking class are harmless to the operator. Therefore, no eye protection is necessary when using these machines. T F
9. A chisel that has a mushroomed head should never be used. T F
10. It is important to know where the chips are falling when one is using a chisel to chip metal away. T F

(Circle true or false)

11. A pupil who gets something in his/her eye in the shop should let another pupil remove the particle from his/her eye. T F

12. If a foreign particle gets in the eye, letting the eye water will only add to the pain. T F

13. The eye should not be rubbed in an attempt to remove a foreign particle. T F

14. Slight scratches may cause permanent damage to the eye due to possible infection of scar tissue. T F

15. If chemicals spatter into the eyes, the eyes should be rinsed thoroughly with clean tap water. T F

*Taken from Oklahoma State Board of Vocational and Technical Education Eye Safety Manual.

LASERS

When lasers are used in the classroom, they should be treated with extreme care. Damage to the eye (retina) will result from exposure to a laser beam. Even very low output lasers can cause damage if the contact, either direct or reflected, is of sufficient length. Various studies have uncovered some noteworthy facts:

1. Helium-neon lasers account for 92 percent of the lasers used in high schools and 79 percent of those used in colleges.

2. Lasers tend to vary from their rated output. Lasers specified at 1.0 milliwatt varied from 0.19 to 3.0 milliwatts. This was true of lasers produced prior to August, 1976.

3. Only half of the schools using lasers were able to locate instruction manuals which contained any safety advice or information.

4. An experiment on Rhesus monkeys showed that as little as 1.9 milliwatts for a time period of one second produced a retinal burn in one monkey. Other monkeys were able to accept greater outputs. It also should be noted that this was a raw, unfocused beam as opposed to the more dangerous focused beam. (W.T. Ham, "Retinal Burn Thresholds for the Helium-Neon Laser in the Rhesus Monkey," Archives of Ophthalmology, 84 (6): 797-809, 1970.)

5. Other studies (C.E. Armstrong, "Eye Injuries in Some Modern Radiation Environments," Journal of the American Optometric Association, 41 (1) 55-62, 1970) have shown that a visible retinal burn occurred on a human eye from an accidental exposure of two milliwatts after an estimated one to two seconds.

6. Experts have estimated that some eye damage may occur (observable through a microscope) at 1/100 of the power expected (2.0 milliwatts) to produce observable results. For educational purposes the maximum output should be specified--0.5 milliwatt is usually sufficient.

7. The Federal Laser Products Standards became effective in August, 1976. All lasers sold after that date should be appropriately labeled as to their power output and primary wavelength. Lasers purchased prior to that time may have energy outputs greater than those specified.

8. Most lasers used in schools are classified as Type II. They have an output of one milliwatt or less and are of the continuous-spectrum type. The following safety practices should be observed:

   A. Direct viewing of the beam should be avoided.

   B. No portion of the body should be placed in the beam.

   C. Unnecessary objects should not be placed in the path of the beam. Objects with mirror-like finishes reflect laser beams and reflected beams are hazardous.

   D. Demonstration equipment, such as support rods and bench surfaces, should be painted or treated to produce a dull, nonreflective surface. All optical components should be rigidly fixed with respect to their position relative to the laser.

9. The beam must be blocked when it is not needed. A cap or shutter is suggested.

10. Laser beams should terminate in a nonreflective, light absorbing material.

11. Testing of equipment, or preparations for demonstrations, should be done without others present.

12. The beam should be deflected in a vertical plane. The laser display system should be contained in a box, open on the side(s), but closed on the ends, top, and bottom. The laser beam axis should be established at a level below or above the eye level height of the teacher or observers. If reflection or refraction of the beam is necessary, it should be deflected in a vertical plane.

13. Expanding lenses should be rigidly affixed to the laser; i.e., illuminating large surfaces.

14. The laser should be equipped with a key switch in the primary power circuit. The toggle-type switch can be discarded.

15. The operable laser should never be left unattended.

16. The power of the laser should be reduced to the minimum required for a specific task. Colored plastic can be used for such a purpose.

17. The area surrounding the laser must be kept well-lighted. This keeps the pupil of the eye contracted, thus making it less susceptible to light.

18. Adequate safety glasses must be provided and used. No one type of protective eyewear is adequate for all wavelengths. Caution must be exercised.

19. One must be aware that an electrical shock is possible from the equipment; i.e., the storage capacitors and power supplies.

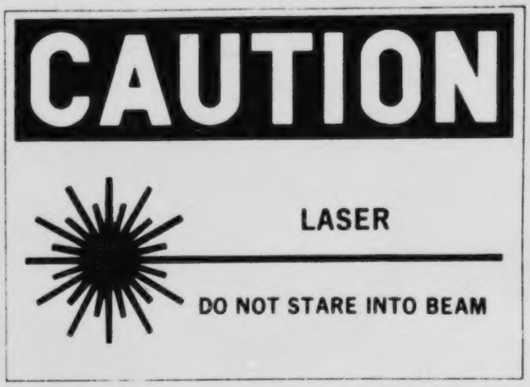
20. High intensity light generated by the pump source should not be viewed directly. Shielding is essential.

Further information on laser use is available from the Office of Information (RH-50), Bureau of Radiological Health, Food and Drug Administration, 5600 Fishers Lane, Rockville, Md., 20857. Another source of information is the American National Safety Institute, 1430 Broadway, New York, N.Y., 10018. Ask for "Safe Use of Lasers," Z-136.1, 1979.

LASER EYE PROTECTION

Lasers are used in some school laboratories. Eye protection in their use depends more upon the energy, wall absorption, and proper procedures than upon protective absorptive lenses. However, safety spectacles are recommended. Each laser wave length requires a particular color and density lens. Hence, lenses must be properly matched to the source; otherwise, little or no protection is afforded. Even with the correct lenses, one must never look directly into the beam.

NOTE: Information on lasers provided by the Divison of Science, North Carolina Department of Public Instruction.


CAUTION
LASER
DO NOT STARE INTO BEAM

CLOTHING

GENERAL RULES

1. Loose clothing must not be worn in laboratory areas when one is operating machinery or equipment. This applies to loose shirts, tails, lapels, torn clothing, long sleeves, ties, baggy trousers and coveralls, flapping jackets, and loose belts.

2. Finger rings, wrist watches, necklaces, bracelets, and dangling earrings are a constant hazard to those in contact with hand or power tools, machines, or parts. It is recommended that they not be worn.

3. In the event clothing is accidentally saturated with a hazardous substance, remove the clothing immediately (possibly while in the shower) and wash thoroughly with a mild soap and plenty of water.

4. Hair protection may be required, either through the use of appropriate headwear or through modification (including facial hair). Long hair can become entangled in machinery or can catch fire. Hairnets, bandannas, fabric caps, or hard hats are recommended as protection. Long mustaches and/or beards may also present personal hazards.

5. Workers whose clothing may become wet due to activities carried out in the performance of their jobs must be provided with protective aprons, coats, jackets, sleeves, or other suitable garments.

HAND AND ARM PROTECTION

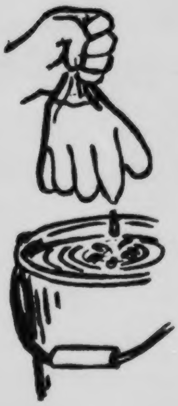
Several different devices may be used for protection: Gloves and mittens, hand pads, finger cots, sleeves, or protective creams.

GLOVES AND MITTENS are intended to provide protection to the fingers and hands, and sometimes to the wrists and forearms. If finger dexterity is necessary, such as that needed in picking up small objects or in handling certain materials, gloves are usually recommended. When finger dexterity is not necessary, mittens may be used. Mittens are also made with separate coverings for thumb, or the index finger or other fingers. Gloves and mittens should not be worn where there is a hazard of having them caught in moving machinery. Some gloves are reinforced with steel finger caps. Others may have steel staples as reinforcing material and are used for handling heavy castings. A third type has a metal mesh and is used for protection against cuts or blows received from edged tools.

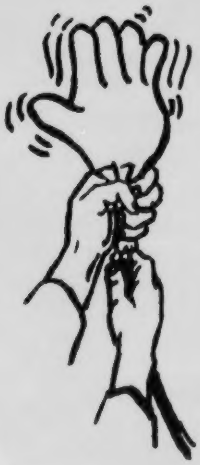
Certain gloves and mittens are used for protection against the flame and heat found in furnace operations, welding, foundry work, or other occupations requiring the handling of hot metals or other substances.

HAND PROTECTION

GLOVES--When handling toxic liquids or particulates (dusty powders or granules), employees/pupils must wear gloves which are impervious to such substances. The gloves should be long enough to protect the forearms. Care must be taken to keep these impervious gloves sanitary in order to prevent dermatitis. The gloves must be inspected frequently for pinholes and discarded when holes are found. Disposable cotton inner liners and hand lotions add further protection. If glove liners are used, they should be changed at least as often as protective clothing is changed.

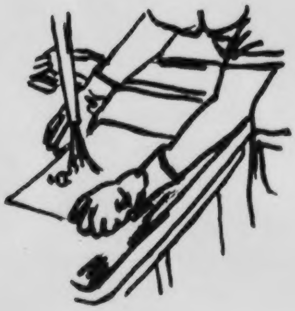


GLOVE TESTING WITH AIRLINE OR WATER



FREQUENTLY VIOLATED REGULATIONS

IMPERVIOUS GLOVES -- "IMPERVIOUS" MEANS THE CHEMICAL CAN'T GET THROUGH. NEOPRENE GLOVES ARE IMPERVIOUS TO NEARLY ALL PLATEMAKING CHEMICALS.



Other types of gloves are used for chemical protection. Their selection should be related to the particular acid, solvent, caustic, oil, or chemical involved.

Rubber gloves are used by utility workers who must work with energized circuits. They are made with long cuffs to protect the hands and wrists from burns and shock. Rubber gloves should resist 10,000 volts for three minutes, and should be inspected frequently for physical defects by trapping air inside the glove. They should also be tested electrically at intervals to assure that they have not lost their insulating quality. Rubber or plastic gloves, used for protection against liquids, should not be confused with gloves used for electrical protection.

Gloves providing protection against X-ray and other radiation are used by medical, industrial, and radiochemical laboratory technicians. They are made of leather or rubber that have been impregnated with lead.

HAND PADS are used to protect the palms of the hands against cuts and abrasions, against burns caused by direct contact with hot objects, or against sparks, flame, or heat. Hand pads are usually heavier and less flexible than gloves or mittens and are used for heavy-duty protection against direct contact.

FINGER COTS provide protection for the finger tips only. They are designed for protection against moisture, acids, alkalis, oil, grease, and solvents, or for protection against cuts. Cots are also used when only the fingers are to come in contact with hot materials.

SLEEVES are worn in conjunction with gloves. They are designed for protection against flame and heat, impact or cuts, or splashing liquids. They are made in three lengths: cuffs for the wrist and forearm, elbow length, and shoulder length. Sleeves are also worn by electricians and linemen for work near live conductors.

MATERIALS FROM WHICH PROTECTORS ARE MADE

HAZARD	MATERIALS
Heat	Asbestos or leather aluminized fabric, glass fiber insulation
Flame	Asbestos, leather, fire-resistant duck, aluminized fabric, glass fiber insulation
Hot metal splashes, sparks	Asbestos, fire-resistant duck, leather, aluminized fabric
Electricity	Rubber
Moisture and water	Rubber, oiled fabric, plastic, coated glass fiber
Mild acids and alkalis	Rubber, plastic, synthetic fabric, coated glass fiber
Strong acids and alkalis	Natural rubber, plastic
Oil and organic solvents	Synthetic rubber, plastic, coated glass fiber
Flying chips, mild impact	Leather, fabric
Severe blows, sharp tools	Wire mesh reinforced leather
X-ray, gamma ray	Leaded rubber, leaded leather

PROTECTIVE CREAMS are the last of the hand and arm protectors to be discussed. Creams are usually used to protect against harmful chemical exposures. Protective creams and lotions form a film barrier on the skin that prevents contact with irritating materials such as alkalis, acids, solvents, cutting oils, etc. Germicidal and antiseptic soaps and detergents are used to remove dirt, grease, oil, and chemicals from the skin after exposure.

OTHER BODY PROTECTIVE APPAREL

APRONS may be either the bib-type, covering the chest, waist and knees or ankles, or the waist-type which lacks the chest-covering bib. Aprons are available for protection against heat, sparks, hot metal splashes, impact and cut hazards, splashing liquids, or radiation hazards.

CAPE SLEEVES are back, shoulder, and arm coverings which extend over the upper chest and may have a detachable bib to protect the lower chest.

JACKETS are used for protection of the upper part of the body, extending all the way to the hips. Jackets for flame and heat hazards are suitable for welding, particularly overhead welding, and for furnace or fire fighting work. Other jackets may be used for chemical protection. Coats and jackets are very similar, with the coats having the added advantage of leg protection. They are used under similar conditions. Coats are also made for protection against harmful radiation.

COVERALLS AND OVERALLS cover the body except for the head, hands, and feet. They protect against heat, flame, and chemical burns.

LUMINSCENT CLOTHING, designed to reflect light from approaching vehicles, is used by policemen, firemen, utility workers, railway yard workers, and others working at night where moving vehicles are a hazard.

RADIATION EXPOSURE SUITS, made of plastic or paper, protect against contamination of the clothing from matter particles. After any exposure involving contamination they are discarded.

OCCUPATIONAL HEAD PROTECTION

HELMETS that protect the heads of occupational workers from the impact and penetration of falling and flying objects, and from limited electric shock and burn, shall meet the requirements and specifications established in American National Standard Safety Requirements for Industrial Head Protection. Z89.1-1969, or successive revisions.

Head injuries are caused by falling or flying objects, or by bumping the head against a fixed object. To guard against such hazards, head protection (in the form of protective hats) must do two things--resist the impact and absorb the shock of the blow. This is accomplished by making the shell of the hat out of a material hard enough to resist the blow, and by utilizing a shock-absorbing lining composed of headband and crown straps which will keep the shell away from the skull of the wearer. Protective hats are also used to protect against electrical shock.

PROTECTIVE HATS generally fall into two types--hats with full brim and brimless caps with peak. Industry classifies them as follows: Class A, general service; Class B, utility service; and Class C, special service. Each type and class of head protector is intended to provide protection against specific hazardous conditions.

CLASS A, GENERAL SERVICE HATS AND CAPS--intended for protection against impact hazards. This type is used in mining, building construction, shipbuilding, tunneling, lumbering, and manufacturing. Dielectric strength is incorporated as an extra safeguard for protection against voltages not exceeding 600 volts.

CLASS B, UTILITY SERVICE--is designed for protection against electrical contact with exposed conductors of high voltage and against impact hazards. They are used extensively by linemen and other electrical workers.

CLASS C, SPECIAL SERVICE HATS AND CAPS--designed specifically for lightweight comfort and impact protection. This class is usually manufactured from aluminum and offers no dielectric protection. These hats are used in certain construction and manufacturing occupations, oil field refineries, and chemical plants where there is no danger from electrical hazards or corrosion. They are also used in any place where there is the possibility of bumping the head on a fixed object.

INSPECTION AND TESTING--all hats should be frequently inspected or tested to be sure that the protection offered by the shell and suspension has not been reduced through wear or rough treatment. Class A hats and caps, while offering protection against 600 volts, are tested to withstand 2,200 volts, alternating current for one minute with leakage not in excess of three milliamperes. Class B hats and caps are tested to withstand 20,000 volts, alternating current for three minutes with leakage not in excess of nine milliamperes.

Classes A, B, and C hats and caps are tested by dropping an eight pound steel ball on the crown from a height of five feet. When mounted on a standard head form, the hat or cap may not transmit an average force of more than 850 pounds. Class A and C hats and caps are tested with a crown clearance of 1 1/4 inches, and Class B headgear is tested with a crown clearance of 1 1/2 inches; a twenty-five pound weight being placed on the shell when the crown clearance is measured.

USAGE OF PROTECTIVE HEADGEAR

All pupils, faculty, and visitors participating in, or observing in a classroom/shop where any of the building/construction trades are the dominant curriculum activity must wear safety headgear.

OCCUPATIONAL FOOT PROTECTION

Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1-1967.

Personal protective equipment to sheild the foot from injury is the accepted method of protection against injuries from heavy falling objects, against crushing from rolling objects, or against lacerations from edged tools. Protective footwear is also used against the hazards of molten metal or electricity. Foot protective devices fall into two main classes--safety shoes and foot guards.

SAFETY SHOES of various kinds are extensively used in many manufacturing industries, in mining, in transportation, in lumbering, and in shipping and warehousing operations. They are generally divided as follows: safety-toe shoes, conductive shoes, explosives-operations (nonsparking) shoes, electrical-hazards shoes, and foundry shoes.

SAFETY-TOE SHOES are the best known of all safety shoes. In fact, they are generally referred to as "safety shoes". Safety-toe shoes are intended to provide protection for the toes from an impact or crushing force by use of a steel toe-box or its equivalent. The toe-box is incorporated into the shoe during construction and is an integral part of the shoe.

Safety-toe shoes are used wherever there is a hazard from falling or rolling objects; including hand or power truck wheels. They are particularly useful in storage and warehousing, in heavy manufacturing operations, and in construction work. In the latter, they offer protection against edged tools, such as axes and picks. The steel toe-box nct only protects the toes but also provides some protection to the instep if the falling object is large enough to hit both the toes and instep. These shoes are made in such a variety of styles that there is a style or type for every kind of job; including office work, dress wear, or around the home.

CONDUCTIVE SHOES are designed to dissipage the static electricity which accumulates in the body of the wearer in order to avoid the creation of static sparks which might ignite explosive gases or materials. They are effective only when the floors on which the person walks are also conductive and grounded. They should never be worn outdoors because dirt impairs their effectiveness. They are conductive because the heels and soles are made of a conductive rubber compound or have a conductive plug in each one. Any cement that is used is also conductive. All metal used in the shoes is nonferrous or is plated with a nonferrous metal. Conductive shoes are, therefore, nonsparking as well as conductive.

Conductive shoes are used in hazardous locations where an explosive concentration of gases or hazardous liquids might be ignited by a static spark. Examples would be hospital operating rooms and certain operations in the manufacture of explosives or chemicals, or in places where such materials are processed or used.

Each new shoe has a tested electrical resistance not greater than 250,000 ohms. They should be tested frequently since dirt and foreign material in the sole affects the electrical resistance. They should be taken out of service if the tested conductivity exceeds 450,000 ohms.

EXPLOSIVE-OPERATIONS SHOES differ from conductive shoes in that the heels and soles are not made of conductive rubber (although they are nonsparking). They are used in hazardous locations where the floors are not conductive and grounded (which is necessary for conductive shoes).

These shoes are made nonsparking by use of nonferrous metals. When metal toe-boxes are incorporated into explosive-operations shoes, the toe-box is rendered resistant to sparking by plating or metalizing with nonferrous metal. Generally these shoes are worn by persons involved in the manufacturing of certain explosive compounds, or by those who clean tanks that have held gasoline or volatile hydrocarbons.

ELECTRICAL-HAZARDS SHOES are intended to minimize any hazards due to contacts with electrical current where the path of the current would be from the point of contact to the ground. They are also intended to give protection to the toes from an impact force. A safety toe is incorporated into the shoe during construction.

These shoes are of leather, with a leather insole and heel. No metal is used except for the toe-box, which is insulated from the shoe. No eyelets are used; nor are the laces metal-tipped. Electrical-hazards shoes protect only when they are dry and in good repair. The protection is greatly reduced if they are wet or worn. These shoes are normally worn by electricians or others working on or around live circuits.

Performance standards for these shoes require that they be capable of withstanding an alternating current of 10,000 volts for three minutes without a leakage of more than 10 milliamperes. They are also tested at 14,000 volts for one minute with a leakage standard of no more than 14 milliamperes.

FOUNDRY (MOLDER'S) SHOES should be worn for three operations in which snug ankle fit, closed upper construction, and speed and ease of removal are the functional protective criteria. This shoe may be made with or without a safety toe-box.

Foundry shoes are made in the so-called "Congress" style. Instead of a lacing, the shoe is made with an elastic goring which holds the upper part tight around the ankle and facilitates ease of removal in case a spark or molten metal should get into the shoe. They are used wherever there is a hazard from splashing metal, such as the pouring of molten metals in foundry operations.

METAL FOOT GUARDS--In addition to the five basic types of safety shoes, a number of other types of foot guards are in general use. Metal foot guards are made of aluminum alloy or galvanized steel coverings. They are attached to the shoes temporarily by means of a heel strap. They protect not only the toes but also the instep against falling or rolling objects.

Metal foot guards are used in forge shops, foundries, paper mills, quarries, packing plants, lumber mills, ice plants, and other operations where there is a hazard from falling or rolling objects. They are particularly useful in hot work--the air space between the guard and the shoe keeps the shoe from becoming uncomforably hot.

Where there is a hazard to the shin, as well as to the foot, a combination foot and shin guard is available. The shin guard is made of the same material as the foot guard and is hinged to it and held in place by straps around the leg. These guards are used where a flying particle hazard exists, such as the breaking of concrete with a jackhammer.

WOOD-SOLED SANDALS, consisting of wood soles held in place by straps over the shoes, are used as protection against heat. They are used by asphalt workers and pavers, by chemical workers, and by workers in tanneries, steel mills, and oil refineries where there may be a hazard from acids, caustics, hot water, or where sharp objects are likely to be encountered underfoot.

EAR PROTECTORS

Ear protectors are of three types--inserts or plugs, muffs, and helmets. EAR PLUGS are inserted into the ear canal to reduce the sound wave before it strikes the eardrum. Plugs are made of soft rubber, hard rubber, wax, plastic, or a combination of these materials. Plugs can be for general purpose use or of individual design. Disposable types of wax and cotton plugs are available. Some ear plugs are fitted with valves and are thus designed to permit the hearing of normal sounds (such as conversation). At any time there is an exposure to noise of a certain intensity, the valve closes and blocks out the sound.

Ear plugs are used where the noise levels are relatively high (in the nature of 90 to 100 decibels), and where a 30 to 40 decibel reduction would materially lessen the possibility of damage to the ear. Muffs and helmets may be used in conjunction with ear plugs to attain even greater effectiveness, especially in the high frequencies (above 1,000 cycles per second).

EAR MUFFS cup and cover both ears and are held in place by a headband. Muffs may also be incorporated in a cap for continuous wear. These cups are made of rubber or plastic materials and are intended to enclose the ear without compressing it. They must fit snugly to the head so that very little leakage occurs. A loose fitting muff may actually amplify low-frequency sounds. The cups contain sound-absorbing materials or perforated disks which discriminate against certain hazardous frequencies. The muff-type protector covers only a part of the mastoid bone and other bones of the skull. Therefore, it does not materially reduce sound due to bone conduction.

Ear muffs are used where high noise intensities and high frequencies are encountered, such as in the testing of aircraft engines or in those areas where extremely noisy machines or processes are used. Ear muffs with grease or liquid-filled seals have been found to be as effective as ear plugs at the lower frequencies.

HELMETS are made to cover most of the bony portions of the head in order to reduce bone conductivity of noise, as well as air-borne noise. Other safety features, such as protection to the head and eyes, can be incorporated into the helmet. For some types of noise exposure, earphone cushions or other muff-type protectors are built into the helmet. Helmets are used principally in connection with jet aircraft operations or where other high frequency noises are present.

SELECTION OF EAR PROTECTORS--The noise intensity and frequency of occurence are determining factors. For intensities up to 100 db. (decibels), with most of the energy in the middle frequency range, plug or ear muff-type protectors are adequate. For 110 db. or over, in the higher frequencies, it would be advisable to use muffs or helmets, perhaps in combination with ear plugs. For extremely high intensities of 130 db. or over, muffs or helmets with plugs are advisable, regardless of the frequencies. Some experimentation may be necessary for each given situation.

Protectors, particularly ear plugs, should be available in different sizes. Employees may need limited instruction in their selection, use, and cleanliness. Daily washing with soap and water is strongly recommended. Employees should never exchange earplugs, as infection is always a possibility. The individual's hands and fingers must be clean when shaping or reshaping the wax or cotton plugs. Finally, individuals should be allowed some freedom in selecting ear protectors, especially if multiple protectors offer comparable protection.

HEARING PROTECTION REQUIRED (OSHA)

1. When employees are subjected to sound levels exceeding those listed in Table G-16, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce the sound levels within the levels of Table G-16, personal protective equipment shall be provided and used to reduce the sound levels within the levels of the table.

2. If the variations in noise level involve maxima at intervals of one second or less, it is to be considered continuous.

3. In all cases where the sound levels exceed the values shown herein, a continuing, effective hearing conservation program shall be administered.

TABLE G-16 PERMISSIBLE NOISE EXPOSURES

DURATION PER DAY IN HOURS	SOUND LEVEL-DBA-SLOW RESPONSE
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

EAR PROTECTION

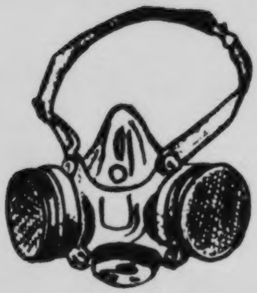
Cotton should not be used as protection against abrasive sound. While a wad of cotton may minimize waves of certain frequencies, it fails to alter the intensity; this providing a false sense of security.

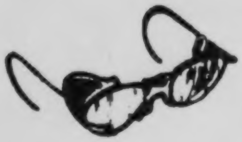
Sound is measured by two fundamental characteristics: frequency (related to pitch) or number of waves per second, and intensity level (related to loudness). The human ear reacts to frequencies ranging from 20 cycles per second to about 20,000. Sound at a level of 85 db. begins to lead to a loss of hearing, depending on: (1) the intensity; (2) the frequency; (3) the duration of exposure; and, (4) individual sensitivity. The following are examples of noise and the approximate db. for each:

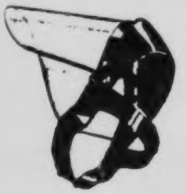
EAR PROTECTION (COND'D)

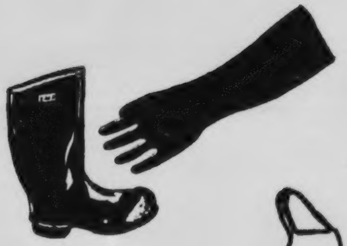
Busy street traffic at about 100 feet	60 db.
Office tabulating machines (electric typewriter,etc.)	80 db.
20 feet from subway	90 db.
Pneumatic diesel air compressor	90 db.
Diesel shovel (idling)	90 db.
Automatic screw machines	95 to 105 db.
Wire rope stranding machine	102 to 108 db.
Header	103 to 108 db.
Circular saw	105 to 115 db.
Between two compressors	110 db.
Drop hammer (depending on size)	110 to 135 db.
Punch press	112 db.
Between two drills, 20 feet apart	117 db.
5 feet from pneumatic press	130 db.
40 feet from jet engine	138 db.
59 feet from rocket engine	150 db.

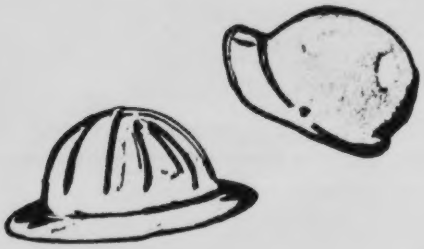
EXAMPLES OF PROTECTIVE EQUIPMENT

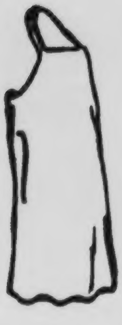


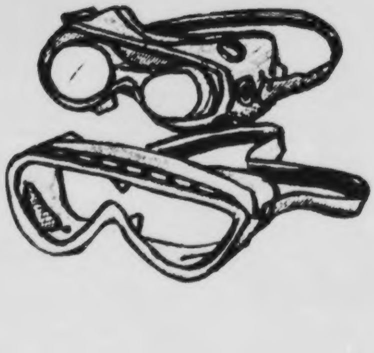


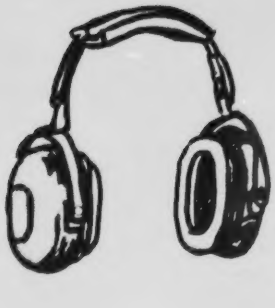








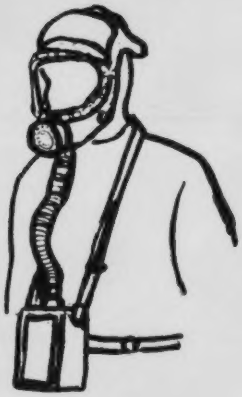




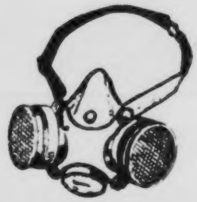
RESPIRATORY PROTECTION

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fumes, sprays, mists, fogs, smokes, vapors, or gases, the primary objective shall be to prevent atmospheric contamination.

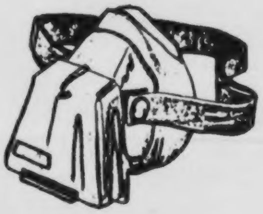
This shall be accomplished, as far as possible, by accepted engineering control measures. For example: enclosure or confinement of the operation; general and local ventilation; and substitution of less toxic materials. When effective engineering controls are not feasible, or while they are being installed or evaluated, appropriate respirators shall be used. (OSHA)



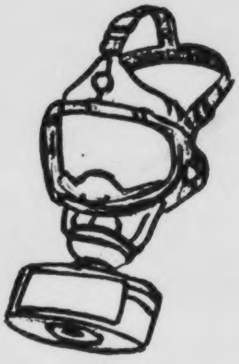
GAS MASK



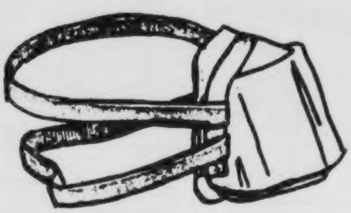
CHEMICAL CARTRIDGE



DUST



CANNISTER
(GAS MASK)



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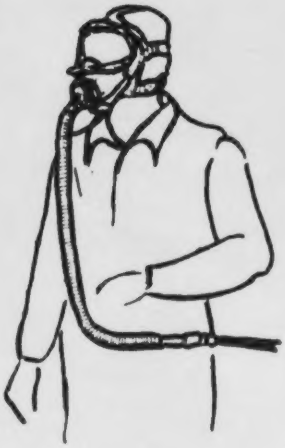


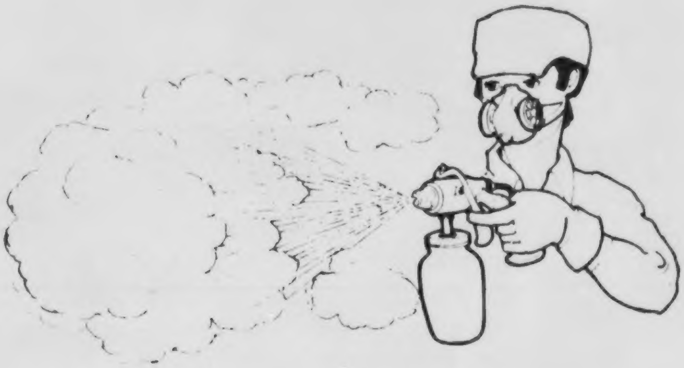
AIRLINE
RESPIRATOR

EMPLOYER RESPONSIBILITY FOR RESPIRATORS (OSHA)

1. Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employees.

2. Respirators which are applicable and suitable for their intended purpose shall be provided.

   RESPIRATORS MUST BE DESIGNED TO PROTECT AGAINST THE SPECIFIC HAZARDS TO WHICH THE WORKER IS EXPOSED.



3. The employer shall be responsible for the establishment and maintenance of a Respiratory Protection Program.

4. The individual responsible for issuing respirators shall be adequately instructed in all phases of respirator performance.

5. Respirators issued to a particular individual shall be marked by date and the wearer's name.

6. Persons using air line respirators in hazardous-to-life conditions shall be equipped with safety harness and safety lines.

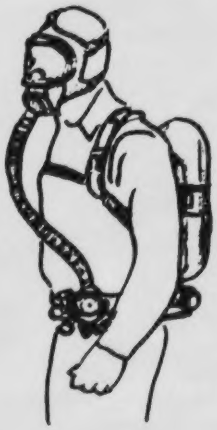
7. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

8. In areas where the wearer, with the failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional man shall be present and shall be equipped with the proper rescue equipment.

9. The respirator wearer shall be given an opportunity to totally familiarize himself/herself with the respirator in a non-hazardous environment.

10. A record shall be kept of the inspection dates and findings on those respirators maintained for emergency use.

EMERGENCY USE RESPIRATORS MUST BE CHECKED MONTHLY AND THE DATE OF SUCH INSPECTION RECORDED.

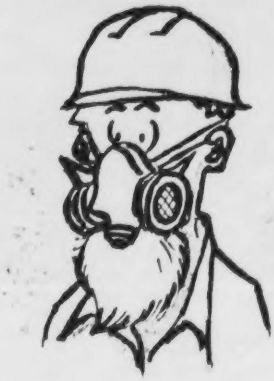


SELF-CONTAINED RESPIRATOR

11. Employers/teachers shall not allow workers (pupils) to wear contact lenses when wearing a fullface respirator.

12. Employers/teachers shall not allow workers (pupils) to wear respirators if the worker (pupil) has long sideburns, a beard, or is wearing a skull cap. These conditions interfere with the respirator's fit and must be removed.

TO MUCH FACIAL HAIR WILL CAUSE A RESPIRATOR TO FIT IMPROPERLY.



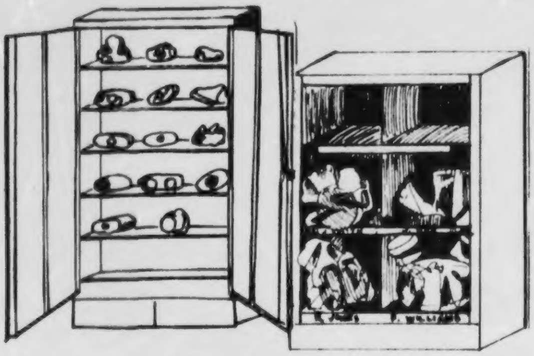
13. Glasses with long temple bars shall not be worn because the bars will break the face seal. Glasses with short temple bars may be temporarily substituted. They may need to be taped to the head to keep them in place. (NIOSH)

14. Replacement of parts or repairs on respirators shall be done only by experienced persons, and then only with parts designed for that particular respirator. No attempt shall be made to replace components or to make adjustments or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or a trained technician for adjustment or repair.

15. The employer/teacher (administration) shall provide adequate storage facilities for respirators.

16. Storage cabinets shall be located in noncontaminated, but readily accessible, areas.

RESPIRATOR STORAGE COMPARTMENTS



AN ACCEPTABLE METHOD OF STORAGE IN A STANDARD STEEL STORAGE CABINET IS SHOWN ABOVE. THE RESPIRATORS ARE STORED IN A SINGLE ROW.

EACH COMPARTMENT IS CLEARLY LABELED WITH THE USER'S NAME, AND THE RESPIRATORS ARE IN PLASTIC BAGS.

RESPIRATORY PROTECTION PROGRAM

1. Written standard operating procedures covering a complete respirator program shall be established and implemented. (OSHA)

2. The chief school administrator or designee shall administer the respirator program in close liaison with the medical department. The responsibility and authority for the respirator program shall be assigned to a single person. The administrator shall have sufficient knowledge of respiratory protection to properly supervise the respirator program.

3. It is strongly recommended that a physician determine what physical and psychological conditions are pertinent for the wearing of the different types of respirators. The respirator program administrator, using guidelines established by a physician, shall determine whether or not a person must be assigned to a task requiring the use of a respirator. This determination shall be reviewed at least annually. (OSHA/NIOSH)

4. Respirators must be approved by the Bureau of Mines or the Department of Agriculture and must be used when they are available. (OSHA/NIOSH)

5. The selection of the proper type of respirator shall be based upon:

    A. The nature of the hazardous operation or process.

    B. The type of respiratory hazard (including physical properties, chemical properties, warning properties, psychological effects on the body, etc.).

    C. The location of the hazardous area in relation to the nearest area having respirable air.

    D. The period of time for which respiratory protection must be provided.

    E. The type of activities engaged in by workers in the hazardous area.

    F. The function and physical characteristics of the various types of respirators.

    G. The guidelines established by the American National Standards Institute.

6. Each respirator wearer shall be given training which will include:

   A. An explanation of the respiratory hazard and what happens if the respirator is not used properly. (OSHA/NIOSH)

   B. A discussion of what engineering and administrative controls are being used and why respirators are still needed for protection.

   C. An explanation of the reasons why a particular type of respirator has been selected.

   D. A discussion of the function, capabilities, and limitations of the selected respirator.

   E. Instruction on how to don the respirator and the methods of checking its fit and operation.

   F. Instruction in the proper wearing of the respirator; including the dangers of removing the respirator in a contaminated area and what to do in emergency situations.

   G. Instruction in respirator maintenance.

   H. Instruction in the recognizing and handling of emergency situations.

7. Each respirator wearer shall be provided with a respirator that fits him/her properly. Quantitative respirator fitting tests should be given, in order to insure that the type of respirator being used will provide an adequate seal on the worker. Quantitative methods are suggested in ANSI Z88.2, along with qualitative methods which can be used if the quantitative tests are impossible.

   A minimum qualitative fit-test for a half-mask respirator requires that the facepiece be fitted with organic vapor cartridges. The wearer dons the respirator and adjusts it for a good fit. A piece of cloth or a stencil brush, soaked in isoamyl acetate (banana oil), is passed round the facepiece, close to the faceseal. If the wearer can detect the odor of the isoamyl acetate, the facepiece should be adjusted until no odor is apparent. If this is impossible, another type of facepiece should be used.

   Each respirator wearer shall be required to check the seal of the respirator prior to entering a harmful atmosphere. This may be done by closing off the exhalation valve and exhaling gently. The fit of the respirator equipped with a facepiece is considered to be satisfactory if a slight positive air pressure can be built up inside the facepiece, without the detection of any outward leakage of air between the sealing surface of the facepiece and the respirator wearer's face.

8. A respirator equipped with a facepiece shall not be worn if facial hair comes between the sealing periphery of the facepiece and the face, or if facial hair interferes with the valve function. If spectacles, goggles, or a face shield must be worn with a facepiece, they must not adversely affect the seal of the facepiece to the face.

9. The proper type of respirator for each respiratory hazard shall be listed in written standard operations procedures. Respirators shall be issued only by people trained to insure that the proper respirator is used against each hazard.

10. A respirator shall be inspected by the wearer to insure that it is in proper working condition.

11. Supervisory personnel shall periodically monitor the use of respirators to insure that they are worn properly.

12. The concentration of the airborne level of the respiratory hazard shall be monitored, as necessary, to insure the proper respiratory protection.

13. Where applicable, medical surveillance of respirator wearers shall be carried out periodically to determine if these respirator wearers are receiving adequate respiratory protection.

14. Respirator maintenance shall be performed regularly on a schedule which insures that each respirator wearer is provided with a respirator that is clean and in good operating condition. Maintenance shall include:

    A. Washing, sanitizing, rinsing, and drying.

    B. Inspection for defects.

    C. Replacement of worn or deteriorated parts.

    D. Storage to protect against dust, sunlight, excessive heat, extreme cold, excessive moisture, damaging chemicals, and physical damage. Respirators shall not be stored in such places as lockers or toolboxes unless they are in carrying cases or cartons.

EMPLOYEE/PUPIL RESPONSIBILITY

1. The employee/pupil shall use the provided respiratory protection in accordance with the instructions and training received.

2. The employee/pupil shall guard against damage to the respirator.

3. The employee/pupil shall report any malfunction of a respirator to the person responsible for its maintenance.

4. The employee/pupil shall know what the hazards are.

5. The employee/pupil shall know the proper maintenance and sanitization procedures.

CLASSIFICATION OF RESPIRATORY HAZARDS

1. Oxygen deficiency.

2. Gas and vapor contaminants.

   A. Immediately dangerous to life or health.

   B. Not immediately dangerous to life or health.

3. Particulate contaminants (aerosols-including dust, fog, fume, mist, smoke, and spray).

4. Combination of gas, vapor, and particulate contaminants.

CLASSIFICATION OF RESPIRATORS

1. Atmosphere-supplying respirators.

   A. Self-contained.
   B. Supplied-air.
   C. Combination self-contained and supplied-air.

2. Air-purifying respirators.

   A. Gas and vapor.
   B. Particulate (aerosols--including dust, fog, fume, mist, smoke, and sprays).
   C. Combination gas, vapor and particulate.

3. Combination atmosphere-supplying and air-purifying respirators.

COMMON RESPIRATORS AND THEIR NIOSH/MESA APPROVAL NUMBERS

RESPIRATOR (CONTAMINANT)	NIOSH/MESA APPROVAL NUMBER
Paint spray; organic vapors; and paint, lacquer, and enamel mists	TC-23C-126
Acid gas, dusts, and mists	TC-23C-165
Acid gas and organic vapors	TC-23C-166
Ammonia, Methyl Amine, dust, and mists	TC-23C-194
Acid gas, organic vapors, dust, and mists	TC-23C-167
Pesticides	TC-23C-199
Dusts and mists (including asbestos)	TC-21C-180
Dusts, fumes, mists, and radon daughters (asbestos dusts, and mists)	TC-21C-194
Organic vapors	TC-23C-119
Acid gas (chlorine, hydrogen chloride, sulfur dioxide)	TC-23C-164
Ammonia and methyl amine	TC-23C-192
Organic vapors, dusts, and mists	TC-23C-121

RESPIRATOR PROTECTION FACTOR (PF)

Respirators shall be selected according to the characteristics of the hazards, the capabilities and limitations of the respirators, and the ability of each respirator wearer to obtain a satisfactory fit with a respirator.

A Respirator Protection Factor is a measure of the degree of protection provided by a respirator to a wearer. Multiplying the permissible time-weighted average concentration or the permissible ceiling concentration, whichever is applicable, for a toxic substance or the maximum permissible airborne concentration for a radionuclide by a protection factor assigned to a respirator gives the maximum concentration of the hazardous substance for which the respirator can be used.

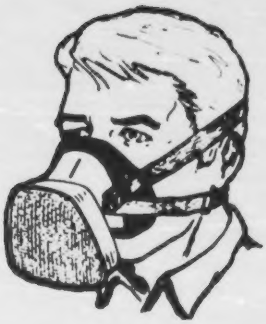
GENERAL DISCUSSION OF RESPIRATORS

Respirators are divided into two groups, AIR PURIFYING and SUPPLIED-AIR.

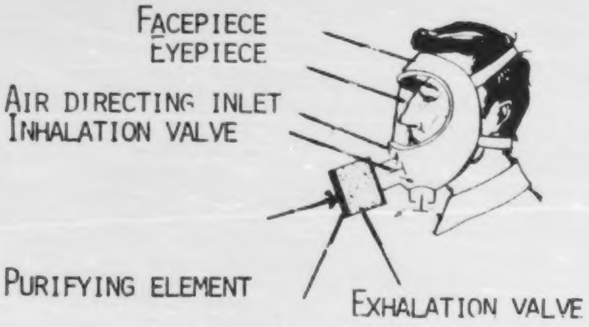
Air purifying respirators use filters and sorbents to remove contamination from the air drawn through them. They may be lung-operated or powered respirators. Lung-operated respirators are called negative pressure types. The lungs draw the contaminated atmosphere through the filters during inhalation. This causes the pressure inside the respirator to fall below that of the surrounding atmosphere, and if there is any leakage point, such as at the faceseal, the contaminated atmosphere will leak straight into the breathing zone. This is one reason why negative pressure respirators are not allowed for protection against highly toxic contaminants or high concentrations of those of lower toxicity. Some supplied-air respirators are also negative pressure types-these are the demand-type respirators. These respirators supply air only when the lungs inhale, and the valve which regulates the airflow operates when the lungs create a negative pressure in the facepiece. Positive pressure respirators supply air to the facepiece at all times and at such a rate that, no matter how hard the respirator wearer inhales, there will always be a positive pressure inside the facepiece, helmet, or hood. Then any leakage will be outwards, into the contaminated atmosphere.

AIR PURIFYING RESPIRATORS

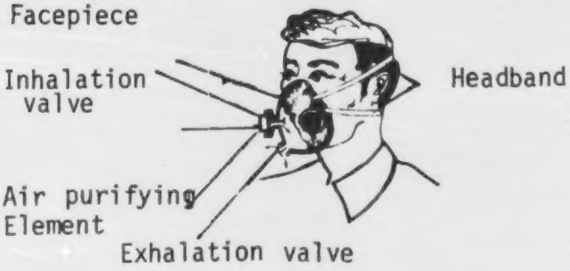
A half-mask respirator seals around the nose and mouth and under the chin. A quarter-mask seals around the nose and mouth and on the chin; while a full facepiece seals in such a way as to cover the nose, mouth, and eyes. Quarter-mask respirators seal less well on the general range of workers faces than do half-masks, which in turn seal less well than full facepieces.



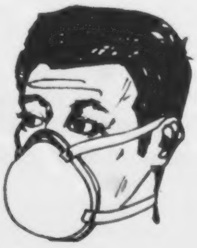
QUARTER-MASK RESPIRATOR


FACEPIECE
EYEPIECE
AIR DIRECTING INLET
INHALATION VALVE
PURIFYING ELEMENT
EXHALATION VALVE

FULL FACEPIECE RESPIRATOR


Facepiece
Inhalation valve
Headband
Air purifying Element
Exhalation valve

HALF-MASK RESPIRATOR



SINGLE-USE RESPIRATOR

Because the quarter-mask respirator is designed to seal on the chin, a person with a short face finds that his/her chin rests inside the faceseal and the respirator does not seal properly. A person with a long face finds that the faceseal at the chin is so near his/her mouth that normal mount movements will break the seal. The half-mask facepiece, if correctly designed, avoids this by providing a deep chin cup in which the chin rests. The facepiece can then be made long enough so that all people, except those with very long faces, will have the chin inside the seal. Also, the chin cup can be deep enough so that people with very short faces can get the chin into it.

The most common leakage point in half-mask respirators is at the top of the cheeks and across the nose. This is why full facepieces are considered to give a better seal--they avoid sealing in this difficult area. Independent tests indicate that some respirators give a better seal than others. It is suggested that potential purchasers of respirators should ask for such data.

To insure that the facepiece is pulled onto the face evenly, the headstraps have to be attached in the correct place. Then, the pressure exerted when the straps are tightened is equally divided around the faceseal. The headstraps must be easily removed to facilitate cleaning, and preferably designed so that the respirator can be easily hung around the neck when not in use. Some straps can be unclipped at the middle and refastened without the need for readjustment of their length.

The faceseal itself must be soft and pliable so that it will conform to the contours of the face. A soft, inturned edge is excellent for this.

Cartridges or filter holders have to be attached to the facepiece so that they make a good seal, and must be in a position where they will reduce vision as little as possible yet not strike the chest or shoulders when the head is turned or lowered. Ideally, they should be easily removed for cleaning. Some kind of positive locking is best.

The exhalation valve should be positioned near the bottom of the facepiece. Moisture which collects here will be blown out through the valve. This valve should be protected from the outside by a cover which can easily be removed and replaced. The valve must always be kept clean. If dirt, hair, or fibers get between the valve and the seat, contaminated air will leak inwards. After cleaning, the valve diaphragm should always be rinsed in clean water and air dried. It should never be dried with a cloth, which might leave small fibers on the diaphragm. The valve assembly is designed to have a very low resistance to air being exhaled from the mask, yet a very low leakage of air into the facepiece during the inhalation. Also, the cover provides for a small reservoir of air. The exhaled breath flushes out any contaminated atmosphere, and in the split second between exhalation ceasing and the valve closing any inward leakage would be exhaled breath rather than contamination.

Briefly respirators should have:

1. A comfortable facepiece that fits a wide range of the working pupulation.
2. Headbands and filter holders that are easily removed for cleaning.
3. Cartridges and filter holders that are easily fitted with a positive lock.
4. No gaskets.
5. No screw threads.
6. An air reservoir at the exhalation valve.

CLEANING AND DISINFECTING

In large programs where respiratory protective equipment is used routinely, respirators should be cleaned and disinfected daily. In small programs where respirators are used occasionally, periodic cleaning and disinfecting is appropriate. Individual workers who maintain their own respirators should be trained in the cleaning of respirators.

METHODS-- The actual cleaning may be done in a variety of ways:

1. The respiratory protection equipment should be washed with detergent in warm water, using a brush; thoroughly rinsed in clean water; and then air dried in a clean place. Care should be taken to prevent damage from rough handling. This method is an accepted procedure for a small respirator program or where each worker cleans his/her own respirator.
2. A standard domestic-type clothes washer may be used if a rack is installed to hold the facepieces in a fixed position. (If the facepieces are placed loose in a washer, the agitator may damage them.) This method is especially useful in large programs where respirator usage is extensive.

DETERGENTS AND DISINFECTANTS--If possible, detergents containing a bactericide should be used. Organic solvents should not be used, as they can deteriorate the rubber facepiece. If this combination is not available, a detergent may be used, followed by a disinfecting rinse. Reliable disinfectants may be made from some available household solutions:

1. Hypochlorite solution (50ppm of chlorine) made by adding approximately two tablespoons of chlorine bleach per gallon of water. A two-minute immersion disinfects the respirators.

2. Aqueous solution of iodine (50 ppm made by adding approximately one teaspoon of tincture of iodine per gallon of water). Again, a two-minute immersion is sufficient and will not damage the rubber and plastic in the respirator facepieces. Check with the manufacturer to find out the proper temperature for the solutions.

POINTS TO REMEMBER ABOUT THE HALF-MASK FACEPIECE

There are two basic methods of protecting the breathing system of a worker: (1) by filtering the atmosphere to remove the contaminants (air-purifying respirators); and (2) by supplying breathable air from a source other than the contaminated atmosphere (air-supplied respirators). Both systems require that the breathing zone (nose and mouth) be isolated from the contaminated atmosphere. The devices for doing this are called respiratory inlet coverings (quarter-mask, half-mask, full-face mask, helmet, hood, blouse, etc.). The quarter-mask, half-mask or full-face mask may be provided with standard filters, high efficiency (dust) filters, canisters (full-face mask), air from a compressed air line, a body mounted system which supplies air or oxygen from compressed gas cylinders.

Each system (e.g. half-mask with standard filters, full-face mask with air line) will have a protection factor associated with it. This is a method of expressing the relative protection afforded by each system. It is a measure of the leakage of the contaminated atmosphere into the breathing zone through the filtering system, the exhalation valve, and the faceseal.

Each filtering system and exhalation valve has to meet specific performance requirements which are easily tested. However, face seal leakage is much more difficult. It is subjective to the user, and no single facepiece of an air-purifying respirator will fit everyone perfectly. It is, therefore, very important that the faceseal of the quarter- and half-mask respirators is correctly designed so that each will have an acceptably low level of faceseal leakage on a wide range of facial shapes and sizes. However, people with beards, some moustaches, or long sideburns will not get a good faceseal.

The quarter-mask fits over the nose; generally in the bridge area, around the mouth, and on top of the chin. The half-mask also fits over the nose and around the mouth, but it fits under the chin. The advantage of the half-mask, is that it is less likely to leak when the mouth is opened. Also, if the chin-cup is designed properly it will fit a bigger range of facial lengths.

Faces vary widely in dimensions--nose widths and lengths, distances between the bridge and chin, mouth widths, jaw widths, and cheek profiles. To fit as many variations as possible, a very careful design is required. A "flat" section which fits over the bridge will accommodate many facial lengths.

The seal itself should be in-turned, soft, and pliable. Then a facepiece can be made to fit both wide and narrow faces with irregular profiles. To insure that the facepiece is held securely onto the face all the way around the seal, without too much pressure, the headband attachments must be precisely located. Then, the pressure from each headband will be "pulled" correctly to prevent movement when normal facial motions are performed. Also the facepiece must be so designed that it will accommodate certain types of industrial safety glasses.

The facepiece should be as small as possible, consistent with comfort. The smaller the "dead volume" inside the facepiece, the less exhaled air is rebreathed. The exhalation valve should be positioned so that the moist exhaled air is carried directly out of the facepiece to prevent condensation within the mast. The inhalation valves should be positioned so that they provide a short and unobstructed path for the air to the nose and mouth. (These latter points are not so important for supplied-air respirators.)

The cartridges or filters must be securely attached to the facepiece in order to prevent leakage where they are sealed. Ideally, a rapid, simple, positive locking system is best. Screw threads may be cross-threaded or become blocked and then will not allow the cartridge to be tightened down. The gaskets may be removed and not replaced. The cartridges or filters should be positioned so that they restrict vision as little as possible, and do not interfere with head movements (by striking the shoulders or chest when the head is turned).

POINTS TO REMEMBER ABOUT DUST FILTERS

Dust filters are made from a mixture of short fibers of wool (40 to 50%) and polypropylene (50 to 60%). These fibers are needled together to produce a felt, 5/32 inch thick. At this stage, the material is a very poor mechanical filter. It removes dust from the air passing through it only when the dust collides with a fiber or is too big to get between the fibers. The air passing through the fibers has to follow a zigzag path. At the sharp turns, the larger particles get thrown out of the airstream and adhere to the fibers, while the medium and smaller-sized ones stay in the airstream and pass through the filter.

To improve efficiency against the smaller and medium-sized particles, a zinc resinate, used to make printing ink, is added to the material. Then, the material is flexed strongly so that the fibers and resinate rub together. This produces an electrostatic charge, positive on the resinate and negative on the fibers, which will last for many years with proper storage. Almost all atmospheric dust has an electrostatic charge which is usually caused during the chemical or mechanical production of the dust. Also, the ultraviolet radiation in daylight will impart a negative charge to the dust.

When the air passes through the filter, the electrostatic charge on the dust is attracted to the charge of the opposite sign on the filter, and this draws the dust out of the airstream. The dust particle still has to be close to the fiber or resin for this to happen, but the collection efficiency is greatly increased. The two charges cancel one another out, so that as the fiber loads up with dust, it loses its charge and returns to the less efficient mechanical filter.

Oil and water also discharge the filter, and some dusts carry less charge than others. Also, there will always be a certain amount of dust which will pass through even a new filter. So the dust and mist filter should not be used to protect against highly toxic dusts, such as some forms of arsenic, beryllium, cadmium, copper, soluble platinum salts, or soluble rhodium salts.

POINTS TO REMEMBER ABOUT FUME FILTERS

Metal fumes and dusts range in particle size from 0.001 to 100 micrometer. A micrometer is one millionth of a meter, or 0.04 thousandths of an inch (40 millionths of an inch). Metal fumes usually contain both dust and fume--the fume being the smaller particles, which may be either solid or liquid. Zinc oxide fumes range from 0.01 to 0.4 micrometer in size, magnesium smoke fumes from 0.1 to 0.4 micrometer, and smelter dusts and fumes from 0.1 to 100 micrometer. Because of the large size range, fume filters require a different construction.

The main filter is of the same material as that of the dust and mist filter. It is permanently sealed into the bottom of the cartridge to prevent the smallest particles "creeping" around the edge. On top of this is a slightly thicker filter made of vinyon and viscose rayon fibers. A third filter, about 1/2 inch thick, is at the top of the cartridge. This too is made of vinyon and viscose rayon fibers, but of a much more open type than the middle filter.

The two upper filters remove the larger particles from the air, while the lower filter handles the smaller particles. This system prevents the lower, main filter from being overloaded with the larger particles, becoming clogged by them, and thus losing its filtering efficiency rapidly. The lower filter alone would rapidly allow fumes to penetrate.

Points to Remember about Gas and Vapor Cartridges

Gas vapor cartridges contain a grandular absorbent which removes certain specific gases or vapors from the air. Gas molecules range in size from 0.0002 to 0.0009 micrometers and would pass through the best dust filter. The best technique used for removing them is different from that of a dust filter.

The grandular absorbent is an activated carbon which, for certain groups of gases (e.g., acid gases), is impregnated with various chemicals.

Points to Remember about Pesticide Cartridges

Pesticide cartridges consist of an organic vapor cartridge with a dust filter rimmed in on top of the top lattice. Two layers of pre-filter material are retained by a paint spray retainer ring on top of the cartridge, and the ring is sealed in place with an adhesive.

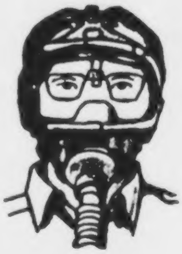
The main filter is the same material as the dust and mist filter, and is rimmed into the cartridge to prevent very small particles of dust from creeping round the edge. The two layers of pre-filter material are each the same as the middle filter of the fume cartridge. Sealing the retaining ring performs two functions. It prevents air from coming in under the ring and bypassing the pre-filters, and it insures that the whole cartridge is thrown away at one time. This latter point is important. When pre-filters are changed, dry dusts (like many pesticides) can be shaken off them and inhaled into the lungs. Also, it prevents the main filter from being overused when the pre-filters are regularly changed.

Points to Remember about Paint Spray Filters

Paint spray filters consist of an organic vapor cartridge which has a laminated particulate filter attached to it. The particulate filter may be changed without replacing the cartridge. Paint droplets vary in size from 0.1 micrometer for enamels to eight micrometers or above for lacquers. The larger particles tend to clog an ordinary dust filter quickly, so two different layers of filtering material are required. The darker inner layer is a material similar to that used in the dust and mist filter. To this is heat-sealed a white, fluffy material similar to the outer filter of the fume cartridge. This outer material removes the larger droplets, particularly the lacquers; while the inner, darker material removes the smaller ones. The organic vapor cartridge removes the solvents that are used as carriers or thinners in the paint. Normally, the filters can be changed several times before the cartridge must be replaced.

WEARING RESPIRATORS

1. Check for any air leaks around the edges when breathing.
2. If the respirator has a full facepiece, pinch off the hose leading into the facepiece and breathe in. The facepiece will collapse if there is a good face seal.
3. Don't wear regular glasses when wearing a full facepiece respirator. The temples break the seal. Special glasses that clip on the respirator should be used.



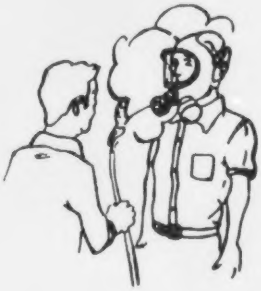
SPECIAL GLASSES WITHOUT TEMPLES MUST BE WORN WITH FULL FACEPIECE RESPIRATORS.

FACEPIECE FIT TEST

The way the facepiece seals to the face varies each time the respirator is put on. With most people, these variations are small. Even so, an occasional poor fit may be obtained, and the respirator may feel well-sealed. With a few people, the faceseal leakage may vary by over 100 times on consecutive fittings, using the same facepiece. TO ACHIEVE THE PROTECTION FOR WHICH THE RESPIRATOR IS DESIGNED IT IS ESSENTIAL THAT SOME FORM OF FACEPIECE FIT-TEST IS PERFORMED BEFORE EACH ENTRY INTO A HAZARDOUS ATMOSPHERE. There are two types of fit test--quantative and qualitative.

QUANTITATIVE TESTS are performed by having the respirator, fitted with the appropriate filters, worn by the worker in an atmosphere which contains a known concentration of a nontoxic aerosol. Then one measures the concentration of that aerosol which leaks into the facepiece via the faceseal. A series of head, face, and body movements are performed so that a highly accurate evaluation of the leakage can be obtained. The facepiece is then tested, as it is worn, without distortion or undue pressure on the face. Quantitative fit tests should, where possible, be performed on each worker who is to be supplied with a facepiece for the first time or is to use a different type of facepiece than he/she has previously used. This should be done at regular intervals (yearly), thereafter. Quantitative fit tests are described fully in the American National Standard Practices for Respiratory Protection, ANSI Z88.2.

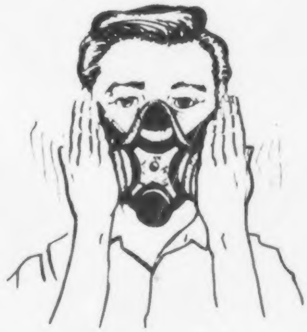
QUALITATIVE FIT TESTS range from blocking off the normal inlet or outlet air paths in the respirator (to see if a vacuum of pressure can be maintained inside the facepiece) to using irritant smoke or highly odorous vapors. Blocking off the air inlets (cartridges or filters) is called a negative pressure test, because the wearer inhales to collapse the facepiece slightly, thereby reducing the pressure inside the facepiece below that of the surrounding air. The wearer holds his breath for a short time. If the facepiece remains collapsed, the faceseal is considered good. The disadvantages of this test are: (1) the filters and cartridges are difficult to seal effectively without special fittings; (2) the facepiece is not normally worn collapsed, and this may improve the seal in some cases; and (3) it may be difficult for some people to stop all airflow into and out of the lungs during the period of the test--they may accidentally compensate for face seal leakage, or unknowingly exhale to give the effect of leakage which is not there.



IRRITANT SMOKE TEST

A POSITIVE PRESSURE TEST is done by blocking off the air outlet (the exhalation valve), because the wearer exhales slightly to raise the pressure inside the facepiece above that of the surrounding air. Any outward leakage of air would indicate an unsatisfactory seal. The disadvantages of this test are: (1) on some respirators it is extremely difficult to adequately seal the exhalation valve; (2) hand pressure on the exhalation valve may unseal the facepiece at a remote point on the seal, which would not happen naturally; (3) the pressure inside the facepiece tends to "blow it off the face" which would not happen normally; and (4) it is sometimes difficult to detect the leakage.

The NEGATIVE PRESSURE TEST (and the positive pressure test) should be used only as a very gross determination of fit. The wearer should use this test just before entering the hazardous atmosphere. In this test, the user closes off the inlet of the canister, cartridge(s), or filter(s) by covering with the palm(s) or squeezing the breathing tube so that it does not pass air; inhales gently so that the facepiece collapses slightly; and holds the breath for about ten seconds. If the facepiece remains slightly collapsed and no



NEGATIVE PRESSURE TEST

inward leakage is detected, the respirator is probably tight enough. This test, of course, can only be used on respirators with tight-fitting facepieces. Although this test is simple, it has severe drawbacks; the main one being that the wearer must handle the respirator after it has supposedly been positioned on his/her face. This handling can modify the facepiece seal.

The disadvantages of the positive and negative pressure faceseal fit tests should not outweigh their advantages. Either test is quick and, depending on the design of the respirator, easy to perform. If no other test is available, they should be done each time the respirator is put on, and the respirator should be adjusted to provide a good seal before entering the contaminated atmosphere.

A better qualitative test can be performed using isoamyl acetate vapor (banana oil). Most people can detect the odor of the vapor below ten parts per million concentration in the air. A piece of material soaked in isoamyl acetate, held close to the faceseal and moved all around it, can locally produce concentrations in excess of 100 parts per million. If the odor is not detected in the facepiece, then a good seal has been made. The test can only be performed when the facepiece is fitted with organic vapor cartridges. If other cartridges or filters are to be used in the work area, the organic vapor cartridges must be removed and the correct cartridges or filters fitted before entering the contaminated atmosphere. The disadvantages of this test are: (1) isoamyl acetate will dull the sense of smell after a time, and not everyone can detect it at ten parts per million; and (2) organic vapor cartridges must be used, and if they subsequently have to be replaced by another type of cartridge or filter, the faceseal fit may be altered. The advantage of the test is that the facepiece is worn in a normal manner.

While all faceseal fit tests have some disadvantages, they will show many of the instances where an inadequate seal has been obtained. One of the above qualitative fit tests must be done before each entry into a contaminated atmosphere. A quantitative fit test must be done each time a new facepiece is issued, or a worker/pupil is fitted with a facepiece for the first time, and at regular intervals afterwards.

> It is important that: (1) The employer/teacher insures that the facepiece to be used will seal correctly on the worker's face. (Quantitative fit test) (2) The employee/pupil checks that he/she has obtained a good seal before entering the contaminated atmosphere. (3) The employee/pupil never removes the respirator in a contaminated atmosphere.

IDENTIFICATION OF GAS MASK CANISTERS BY COLORS

1. The primary means of identifying a gas mask canister shall be by means of properly worded labels. The secondary means shall be by color code. (OSHA)

2. Each gas mask canister shall be painted a distinctive color or combination of colors indicated in Table I-1. (OSHA)

COLOR OF GAS MASKS - TABLE I-1

ATMOSPHERIC CONTAMINANTS TO BE PROTECTED AGAINST	COLORS ASSIGNED*
Acid gases	White
Hydrocyanic acid gas	White with 1/2 inch green stripe completely around the canister near the bottom
Chlorine gas	White with 1/2 inch yellow stripe completely around the canister near the bottom.
Organic vapors	Black
Ammonia gas	Green
Acid gases and ammonia gas	Green with 1/2 inch white stripe completely around the canister near the bottom
Carbon monoxide	Blue
Acid gases and organic vapors	Yellow
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2 inch blue stripe completely around the canister near the bottom
Acid gases, organic vapors, and ammonia gases	Brown

COLOR OF GAS MASKS - TABLE I-1 (CONT'D)

ATMOSPHERIC CONTAMINANTS TO BE PROTECTED AGAINST	COLOR ASSIGNED*
Radioactive materials, excepting tritium and noble gases	Purple
Particles (dust, fumes, mists, fogs, or smokes) in combination with any of the above gases or vapors.	Canister color for contaminant, as designated above, with 1/2 inch gray stripe completely around the canister near the top
All of the above atmospheric contaminants	Red with 1/2 inch gray stripe completely around the canister near the top

**Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

NOTE: Orange shall be used as a complete body, or stripe color, to represent gases not included in this table. The user will need to refer to the canister label in order to determine the degree of protection the canister will afford.

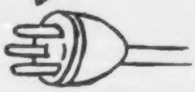
ELECTRICAL PROTECTION

Electrical equipment is found in nearly every vocational subject area. Pupils shall be taught the dangers present in electrical equipment and wiring, and learn how to protect themselves and others from injury.

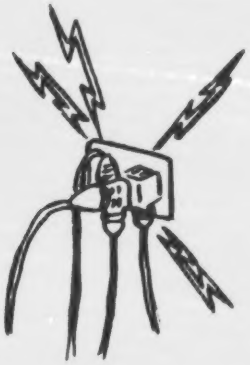
Points to remember:

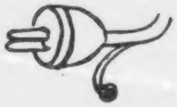
1. Install all electrical wiring in compliance with the National Electrical Code.

2. Never use temporary wiring. All extension cords for tools and appliances must be three-wire parallel ground with grounding lug plugs. Do not overload the circuit.



THREE-PRONG PLUG





3. Treat all electrical equipment as if it is "live."

4. Never bypass safety interlocks (i.e., circuit breakers, fuses, etc).

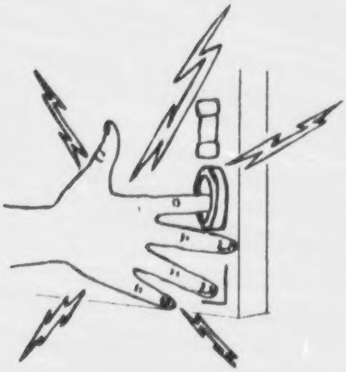
5. Never work on electrical equipment alone; always have someone else nearby.

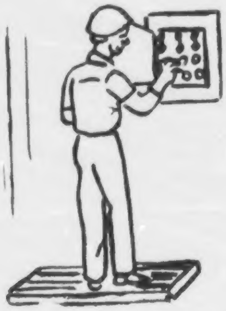
6. While working on electrical equipment, stand on rubber mats or wooden floors. Wear protective gloves and hat.

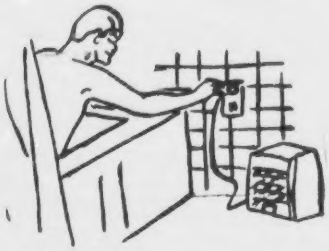
7. Use safety lights in closed or fume-laden areas. When working in a closed area, or in a place where volatile fumes could collect, one should use only approved, sealed safety lights and explosion-proof equipment. Some explosions in the past haven't killed anyone, but those present were electrocuted by the bare wires whipping around as a result of the big boom.

8. Make sure that grounding is proper and complete. Most electrical industrial equipment comes with carefully designed grounding provisions. Most cords use three or four-wire cable to ensure one's safety, by providing a built-in low-resistance path to ground in case of a short circuit. Don't guess about this. If there is any doubt about the condition or function of any electrical equipment one may have to use, get help from authorized and trained personnel instead of taking a chance.

9. Touching a bare wire, an exposed socket, or a faulty electrical tool or appliance may give a person an electrical shock. Shock hazards also exist inside various types of electronic equipment and around power lines. The possibility of shock is greatly increased if the person is also in contact with a ground surface, or if the floor or his/her body is wet.

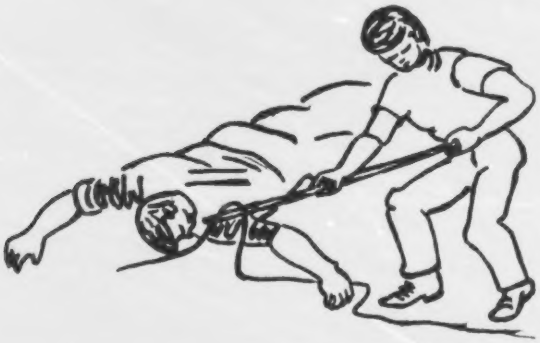






In attempting to rescue someone that is in contact with an electrical source one should:

1. Shut off the current quickly.
2. Attempt to move the victim away from the conductor, using some sort of insulating material, if the current cannot be shut off quickly.
3. Not touch the victim until electrical contack is broken. Use a wooden pole, such as a broom handle, to separate the victim and the conductor. A large cloth, such as a coat, may be used.



4. Move the victim quite a distance from the conductor as a line conductor may cling to the victim.
5. Apply CPR immediately if the victim is not breathing. Speed is essential! In 600 cases studied, 70 percent recovered when artificial respiration was applied within three minutes. Another minute of delay reduced the figure to 58 percent. Five minutes are too long--the chances are slim.

"SURE DEATH"

Two hundred thirty milliamperes of current flowing through one's body in the region of the heart is well within the band of current flows labeled "SURE DEATH." This is the area where the heart stops pumping and just trembles ineffectually (ventricular fibrillation). Naturally, the effect of current flow on the body varies not only with its intensity, but also with the path it follows.

EFFECTS OF ELECTRICAL SHOCK

To get an idea of the effects of so-called "low voltage" shock, let's see what happens when a sixty-cycle alternating current at 110 volts passes through a person from hand-to-hand or hand-to-foot. As the current flow gradually increases, the following effects become apparent:

1. 1 to 8 MILLIAMPERES --a sensation of shock; not very painful. A person can still let go because muscle control is not lost.
2. 8 to 15 MILLIAMPERES--painful shock, but still one can let go. The hazard up through this amount of current flow often comes from the so-called "fright reaction" or recoil when the shock occurs. People have fallen from ladders and other high locations or have bumped their heads hard enough to cause unconsciousness, increasing the possibility of continued current flow; thus prolonging the exposure.
3. 15 to 20 MILLIAMPERES--loss of muscle control begins, and the person cannot let go in spite of the painful shock. At 25 MA one will be "frozen" to the point of contact.
4. 20 to 50 MILLIAMPERES--severe muscle contractions include those muscles controlling breathing. In addition to the difficulty in breathing, the victim may be "knocked out".
5. 50 to 75 MILLIAMPERES--almost certain unconsciousness.
6. 75 to 100 MILLIAMPERES--as the current nears 100 MA, the person is almost certain to die. Ventricular fibrillation sets in and the heart no longer circulates blood in the body. Even after the current is cut off, no pulse can be detected. Artificial respiration should be attempted. However, unless a trained physician can restore the natural rhythmic action of the heart by massage or controlled electrical shock treatment, using special equipment usually found only in hospitals, it's almost impossible to save the victim's life. Usually, the maximum time limit for resumption of natural heart function under these circumstances is about six minutes.

   (Closed heart massage is taught in many first aid courses. This technique, applied by a person trained in its use, may save a life if used prior to the arrival of medical personnel.)
7. 0.20 to 2 AMPERES--this intensity of flow will paralyze the nerves near the diaphragm or the nerve centers at the base of the brain. Breathing will be cut off.

8. 2 AMPERES and over--the person will suffer severe burns due to "frying" of the body fluids and to external arcing at the point of contact. In addition, internal burns of the slow-healing type will also occur. This latter fact might seem academic under the circumstances, but a peculiar thing sometimes happens when flows of above ten AMPS occur for very short periods. The severe muscle contractions the person experiences may prevent ventricular fibrillation. After release, if the proper first aid is administered soon enough, he/she might survive if the heart picks up its regular pumping rhythm again.

The tabulation above is a general guide only. Naturally there will be variations due to individual circumstances. The physical condition of the victim may be a factor. But the important thing to remember is that fewer low voltage shock victims can be revived than those receiving 1,000 volts or more.

WHAT ONE MUST KNOW ABOUT ELECTRICITY

With the foregoing facts in mind, a summing-up exercise can be done in relatively few words. Although one must be aware of the many variables in cases of electrical shock, and the hazards which cause them, some general statements can be made which will apply to almost all circumstances.

1. If the body becomes part of a circuit, either as the load or as the conductor and the load, a person will get an electrical shock.

2. The body will become part of the circuit if one comes in contact with both a source of potential and a ground while one's total resistance is low enough to allow a flow of current.

3. Current flow is what kills or injures--the voltage only pushes the current through body resistance.

4. Direct current (DC) is generally considered to carry less shock hazard than alternating current (AC) for a given voltage, but it is likely to burn more severely since the arcs from DC are more persistent than those from AC.

5. Body resistance is highly variable, principally because of the changes in skin resistance from one body area to another due to the thickness and amount of moisture on the surface.

6. Electrical energy sources (AC or DC)--operating with an open circuit potential of 30 volts or more, with a capability of delivering 2.5 milliamperes or more into a short circuit--are hazardous to a person.

7. Low voltage (less than 600 volts) can be more dangerous than high voltage. Accurate statistics show that 62 percent of victims recovered after being knocked out by potentials over 1,000 volts; for lower voltages, only 39 percent recovered.

8. The seriousness of electrical shock depends on the balance between several factors: the voltage, the body resistance, the amount of current flow and its path through the body, the duration of contact, and the condition of the body organs in the current path.

9. The most hazardous currents are those in the frequency range from 20 to 100 cycles per second (cps). Currents of higher frequencies are less hazardous because they tend to flow on the surface of conductors rather than through the conductors themselves. High frequency current will cause electrical shock, but to a lesser extent for a specific current value.

10. The current required to operate just one 100-watt light bulb is eight to ten times the amount that is needed to kill a person.

ELECTRICAL PROTECTIVE EQUIPMENT

Rubber protective equipment for electrical workers shall conform to the requirements established in the standards set by the American National Standards Institute, as specified in the following list: (OSHA)

ITEM	STANDARD
Rubber insulating gloves	J6.6-1967
Rubber matting for use around electric apparatus	J6.7-1935(R1962)
Rubber insulating blankets	J6.4-1970
Rubber insulating hoods	J6.2-1950(R1962)
Rubber insulating line hose	J6.1-1950(R1962)
Rubber insulating sleeves	J6.5-1962

Electrical-hazards shoes are intended to minimize the hazards due to contacts with electrical current where the path of the current would be from the point of contact to the ground. (See section on foot protection.) Hats, gloves, sleeves, and aprons, as well as special electrical protective devices offer additional protection. (NIOSH)

SAFETY EQUIPMENT SURVEY: GLOVES - ART DEPARTMENT

GLOVES are one of the most important ways of preventing skin problems because the hands and fingers are the skin areas most commonly exposed to hazards. There are gloves available which can protect you against most skin hazards. These include chrome-tanned leather gloves for protection against heat, sparks, and chipping; cotton or fabric work gloves for protection against dirt, abrasion, slivers, cold, etc.; metal mesh gloves for protection against saws, knives, and similar tools; and plastic and rubber gloves for protection against toxic chemicals. Asbestos gloves are not recommended because they can release cancer-causing asbestos fibers into the air when they begin to wear out.

GLOVES that protect against toxic chemicals can be either pure rubber or plastic for greater dexterity, or they can be coated onto a fabric support for greater durability. One problem is that there is no single type of glove that will protect against all chemicals. Therefore, one has to choose a type of glove that will protect him/her against the chemicals with which he/she is working. The Glove Selection Chart that follows was compiled from the product literature of several companies.

THE ACTUAL LIFE OF A GLOVE will depend on conditions of use; including the length of contact with chemicals, temperature, concentration of the liquid, and physical wear and tear. For example, gloves will last longer if they are being used just to protect the hands against solvent-soaked rags than they will if the gloves are dipped into pure solvent for extended periods. The life of gloves (and hands) can also be prolonged by washing the gloves with soap and warm water (before removing them) and then allowing them to air dry before reusing them.

THE GLOVES available in hardware stores or art supply stores for protection against chemicals are usually either latex or polyvinyl chloride ("vinyl") gloves. As the table shows, these gloves do not provide protection against many solvents. Other types of gloves can be purchased from safety equipment companies and scientific supply houses.

SAFETY EQUIPMENT SURVEY: GLOVES

GLOVE SELECTION CHART

Chemical	Natural rubber or latex	Neoprene Rubber	Latex Neoprene	Butyl Rubber	Buna-N or NBR Rubber	Nitrile	Polyvinyl Chlroide
Acetic acid	G	G	G	G	G	G	G
Acids (dilute)	G	G	G	G	G	G	G
Acids (concentrated)	NR	G	G	G	NR	NR	NR
Alkalis	G	G	G	G	G	G	G
Alcohols	G	G	G	G	G	G	G
Aromatic hydrocarbons (toluene, xylene)	NR	NR	V	NR	G	G	NR
Chlorinated hydrocarbons (methylene chloride, methyl chloroform)	NR	V	V	V	NR	G	NR
Ketone (e.g., acetone)	G	G	G	G	NR	NR	NR
Lacquer thinner	NR	NR	V	NR	G	NR	NR
Paint and varnish remover	NR	V	V	V	V	G	NR
Paint thinner	NR	G	G	NR	G	G	NR
Petroleum distillates	NR	G	G	NR	G	G	NR
Phenol (carbolic acid)	NR	G	G	G	G	G	G
Polyester resin	NR	NR	V	NR	V	G	NR
Turpentine	NR	G	G	NR	G	G	NR

G-good; V-variable; NR-not recommended

Michael McCann, PhD., Artists Beware-Hazards and Precautions in Working with Art and Craft Material, pub. by Watson-Guptill Publications, 1979

Personal Protective Equipment: Apparel

CLIMATE

Clothing is imperative to the human body for protection. In warm climates you should consider the following points.

1. Clothing can conserve body energy.

2. Openings around neck, wrists and andles would need to be large and loose to allow the air to circulate.

3. Smooth, sleep fabrics feel cooler to the touch than fuzzy, fleecy ones.

4. White garments tend to reflect the summer sun.

In cold climates consider these points.

1. The openings around necklines, wrists and ankles should be close fitting to entrap air.

2. Thick fabrics tend to insulate better than thin ones.

3. Dense fabrics with tightly packed yarns insulate well against the wind.

4. The texture plays a considerable part in insulating. Napped, fuzzy, and fleecy fabrics all trap air and insulate better than smooth fabric.

HEALTH AND SANITATION

Clean textile fabrics give greater protection to the skin. Dirty and soiled clothing can contain large numbers of microorganisms that can grow and multiply on clothing for a considerable time span. These microorganisms can also be transferred to other articles of clothing through laundering. See Section 11 on Linen and Laundry.

OCCUPATIONAL PROTECTION

Usually the function of the clothing is closely related to the design rather than the design being related to the fashion trends.

1. Protection from the sun

    - large, big brimmed hats
    - clothing covering arms and legs

2. Protection from liquid irritants
    - rubber/snythetic gloves
    - rubber/snythetic aprons
3. Protection from mechanical dangers
    - leather gloves and shoes
    - tailored, close-fitting clothing
    - little or no jewelry or accessories
4. Protection from extreme hazards
    - air proof suits

NOTE: See Section V for more information about fabric inflammability.

Personal Protective Equipment: Hair Restraints

NOTE: See Section V on hair restraints as it applies to clothing equipment, and Section XI for food handlers/sanitation.

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PERSONAL PROTECTIVE EQUIPMENT--SCIENCE LABORATORY

CHEMICAL GOGGLES--Protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by the use of such equipment. It is the responsibility of the school to make conveniently available a type of protector suitable for the work to be performed, and all pupils shall be required to use such protectors.

The monogoggle, with hooded vents, may be worn with prescription glasses. It will provide impact and splash protection, will give adequate dust protection in most school laboratory situations, and has considerable fume protection. Monogoggles are considered the most desirable for all science classes.

The school shall provide the equipment and material to clean and sterilize those goggles used on a community basis.

It is strongly recommended that the wearing of contact lenses in the chemistry laboratory be discouraged. If worn, protection by goggles should be required. When one is wearing contact lenses in the science laboratory, there is a distinct possibility that chemicals may infuse under the contact lenses and cause irreparable eye damage.

SAFETY SHOWERS should be placed in readily accessible areas wherever chemicals are being used. Water flow pressure must be sufficient to drench the subject rapidly. The shower areas must be kept clear of obstruction. Water of drinking purity should be used in safety showers. The showers should be tested on a regular basis and a record kept of the tests. Every pupil should be instructed as to the location of the nearest safety shower and how to operate it.

EYEWASH STATIONS AND FOUNTAINS--At least one eyewash device should be in every science laboratory where chemicals are used, but not where they could become contaminated. The eyewash should deliver a gentle flow of aerated water. For a chemical splash, large amounts of water are needed. It is recommended that the eye be forcibly held open while flushing it for 15 minutes.

REFRIGERATORS may constitute a hazard because of the danger of explosion if they are used to store certain chemicals. Domestic (household type) refrigerators must not be used to store flammable chemicals. Refer to Section XII, Flammable and Combustible Materials. Food and chemicals must not be stored together in any refrigerator. Chemicals stored in refrigerators should be sealed and labeled with the name of the material, the date when they were placed in the refrigerator, and the name of the person who stored the material.

FUME HOOD--Chemistry laboratories should be equipped with functional fume hoods, and they should be in operation whenever toxic or flammable gases are being produced. Fume hoods should be sufficiently effective so that substances with strong odors are not detectable by the laboratory worker. The venting of the exit ports must be such that the exhaust gases will not be recirculated, regardless of wind direction.

LIST OF MANUFACTURERS OF PERSONAL PROTECTIVE EQUIPMENT

1. American Optical Corporation, P.O. Box 7155, Denver, CO. 80207 (manufacturers of safety eyewear)
2. Apex Safety Products, P.O. Box 250, Sanford N.C. 27330 (manufacturers of eye and face protectors, hearing protectors, respirators, and first aid supplies)
3. Bausch and Lomb, 1400 N. Goodman St., Rochester, NY, 14602 (manufacturers of eye protectors)
4. Bel-Art Products, Pequannock, N.J., 07440 (manufacturers of safety eyewear, first aid equipment, fire extinguishers, sanitary supplies, protective aprons, safety signs, etc.)
5. Binks Manufacturing Co., P.O. Box 66090, Chicago, IL., 60666 (manufacturers of respirators, protective clothing, and safety eyewear, etc.)
6. H.L. Bouton Co., Inc., 320 Main Street, Buzzards Bay, MA., 02532 (manufacturers of eye protective equipment.)
7. Bradley Corporation, P.O. Box 309, Menomonee Falls, WI., 53051 (manufacturers of safety showers, eyewash station, hand basins, etc.)
8. E. D. Bullard Company, 2680 Bridgeway, Sausalito, CA., 94965 (manufacturers of headwear, hearing protectors, first aid supplies, alarm systems, industrial hooks, respirators)
9. Cesco Safety Products, 100 East 16th Street, Kansas City, MO., 64108 (manufacturers of head, eye, and respiratory protection equipment).
10. Delaware Valley Safeguards Co., Inc., R.D. #1, Leesport, PA., 19533 (manufacturers of eye, head, hearing, and respiratory safety equipment)
11. Eastern Safety Equipment Co., Inc., 45-17 Pearson Street, Long Island City, NY, 11101 (manufacturers of eye, head, hearing, first aid, clothing, and other safety equipment)

12. Ellwood Safety Appliance Company, Inc., 225 Sixth Street, Ellwood City, PA., 16117 (manufacturers of safety footwear, legwear, etc.)

13. ESB Incorporated, Willson Division, P.O. Box 622, Reading, PA., 19603 (manufacturers of eye, head, hearing, and respiratory safety equipment.)

14. Fibre-Metal Products Company (rural Delaware County), Concordville, PA., 19331 (manufacturers of eyewear, welding helmets, hearing protectors, handshields, and protective windows and screens)

15. Frommelt Industries, Inc., Safety Products Division, 2455 Kerper Boulevard, Dubuque, IA., 52001 (manufacturers of area protection, screens, shields, roller curtains, and various types of protective wear)

16. General Scientific Equipment Company, P.O. Box 27309, Philadelphia, PA. (manufacturers of all types of personal protective equipment, showers, eyewash stations, signs, safety containers, storage cabinets, receptacles, water coolers, first aid supplies, respirators, screens, and windows, etc.)

17. Glendale Optical Company, Inc., 130 Crossways Park Drive, Woodbury, Long Island, NY, 11797 (manufacturers of face, head, hearing, and respiratory protection)

18. Haws Drinking Faucet Company, Fourth and Page Streets, Berkeley, CA., 94710 (manufacturers of safety showers and eyewash fountains)

19. Justrite Manufacturing Company, 2454 Dempster Street, Des Plaines, IL., 60016 (manufacturers of safety containers, storage cabinets, etc.)

20. Marion Health and Safety, Inc., 9233 Ward Parkway, Kansas City, MO., 64114 (manufacturers of first aid kits, hearing protectors, lotions, etc.)

21. Norton Company, Safety Products Division, 2000 Plainfield Pike, Cranston, RI., 02920 (manufacturers of eye and face, head, hand, hearing, respiratory, etc., protection)

22. Rockford Safety Equipment Company, P.O. Box 5166, Rockford, IL., 61125 (manufacturers of eye and face, head, hearing, hand, and protective clothing, as well as various types of industrial safety and protection equipment)

23. Rose Manufacturing Company, 2250 S. Tejon Street, Englewood, CO., 80110 (manufacturers of safety belts and harnesses, etc.)

24. Sellstrom Manufacturing Co., Palatine, IL., 60067 (manufacturers of eye and face, head, hearing, and respiratory equipment, as well as storage cabinets for eyewear)

25. Speakman Company, 301 E. 30th Street, Wilmington, DE., 19899 (manufacturers of emergency showers, eyewash stations, and laboratory equipment)

26. Steel Grip Safety Apparel Co., 700 Garfield Street, Danville, IL., 61832 (manufacturers of finger guards, body safety apparel, shoes, foot guards, welding screens, sleeves)

27. Swinger Safety Products, Inc., 444 North Lake Shore Drive, Chicago, IL., 60611 (manufacturers of "area protection," fire protection equipment, hand protection, body protection, and various industrial safety guards and production equipment)

28. United States Safety Service Company, Parmelee Industries, Inc., (subsidiary) 1535 Walnut St., P.O. Box 1237, Kansas City, MO., 64141 (manufacturers of hearing and eye protection)

29. Western Drinking Fountains, 2085 Burroughs Ave., San Leandro, CA., 94577 (manufacturers of emergency showers and eyewash stations)

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

Accident Prevention for Industrial Arts and Vocational and Technical Education Programs, Oklahoma State Board of Vocational and Technical Education, Oklahoma City, Oklahoma

American National Standard Practice for Occupational and Educational Eye and Face Protection, American National Standards Institute, Inc., 1430 Broadway, New York, New York, 10018

______ Bouton, H. L. and Company, Inc., 320 Main Street, Buzzards Bay, Massachusetts, 02532 (manufacturers of eye protective equipment)

Connecticut Eye Safety Manual, Bureau of Vocational Services, Connecticut State Department of Education, Hartford, Connecticut, 06115

______ Day-Star Safety Corporation, 1518 N. Topping, Kansas City, Missouri, 64120 (manufacturers of respirators)

Eye Safety in Arizona Education, Arizona State Department of Education, Phoenix, Arizona

Fiberglass Layup and Sprayup, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

General Guide to Eye and Hearing Safety, The, General Scientific Co., P. O. Box 27309, Philadelphia, Pennsylvania 19150

General Industry Safety and Health Standards, U. S. Department of Labor, Occupational Safety and Health Administration, Washington, D. C., 20210

Germicon Report, The, Applied Ultraviolet Technology, Box 340, Goshen, Indiana, 46526

Good Work Practices for Tannery Workers, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

Health and Safety Guide for Sawmills and Planning Mills, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

Hollen, Norma and Jane Saddler, Textiles, Macmilla, 1973.

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Occupational Safety and Health in Vocational Education: A Guide for Administration, Faculty, and Staff, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

Personal Protective Equipment, (Bulletin 231) U. S. Department of Labor, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 20402

Planning and Equipping Industrial Arts Instructional Facilities, Instructional Materials Laboratory, University of Missouri-Columbia, Columbia, Missouri

Rendering Plants - Good Practices for Employees, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

Respiratory Protection...An Employer's Manual, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

Respiratory Protection...A Guide for the Employee, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

Safety First in Science Teaching, Division of Science, North Carolina Department of Public Instruction, Charlotte, North Carolina

Safety Guide, Washington State Department of Education, Division of Industrial Arts, Seattle, Washington

Safety Handbook, South Carolina State Department of Education, Vocational Division, Columbia, South Carolina

Urethane Foams, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, Ohio, 45226

Willson/Vic DeWitt Co., Inc., 911 E. Third St., Wichita, KS., 67214

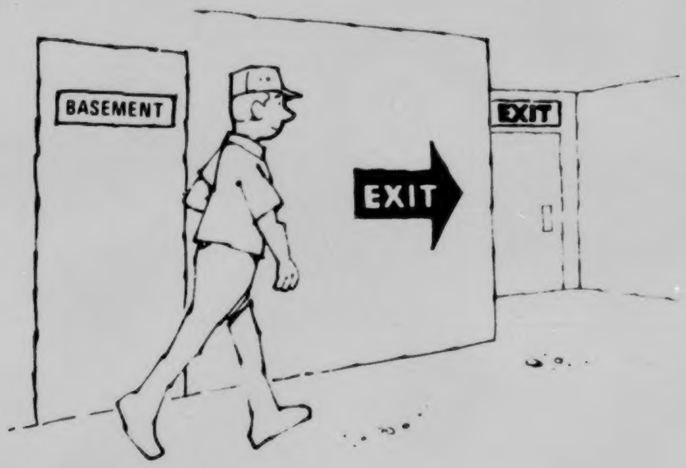
ACCIDENT PREVENTION SIGNS AND TAGS

EXITS AND EXIT MARKINGS

Probably the most important sign in any building or room is the "EXIT" sign. In the past, many lives have been lost because exits were improperly marked, or because doors that were not exits were not marked. The excited occupants of an enclosure where an emergency may arise waste precious time on non-exit openings. Because of the importance of exit markings, they are being treated separately from other signs.

SIZE AND PLACEMENT OF SIGNS (NIOSH)

1. Every exit must have the word "EXIT" in plain, legible letters not less than 6 inches high with the strokes of the letters not less than 3/4 inch wide.
2. The visability of the sign must not be impaired by decoration, furnishings, or other signs.
3. Doors, passageways, or stairways which are neither exits nor ways to an exit, but may be mistaken for an exit, must be clearly marked "NOT AN EXIT" or with a sign indicating their actual use; e.g., "STORAGE ROOM" or "TO BASEMENT."



4. In areas where the direction to the nearest exit may not be apparent to an occupant, an exit sign with a directional arrow must be used.

5. Exit signs must be illuminated by a reliable light source if occupancy is permitted at night, or if normal lighting levels are reduced at times during working hours.

GENERAL REQUIREMENTS (NIOSH)

1. The exit route must lead to a public way.

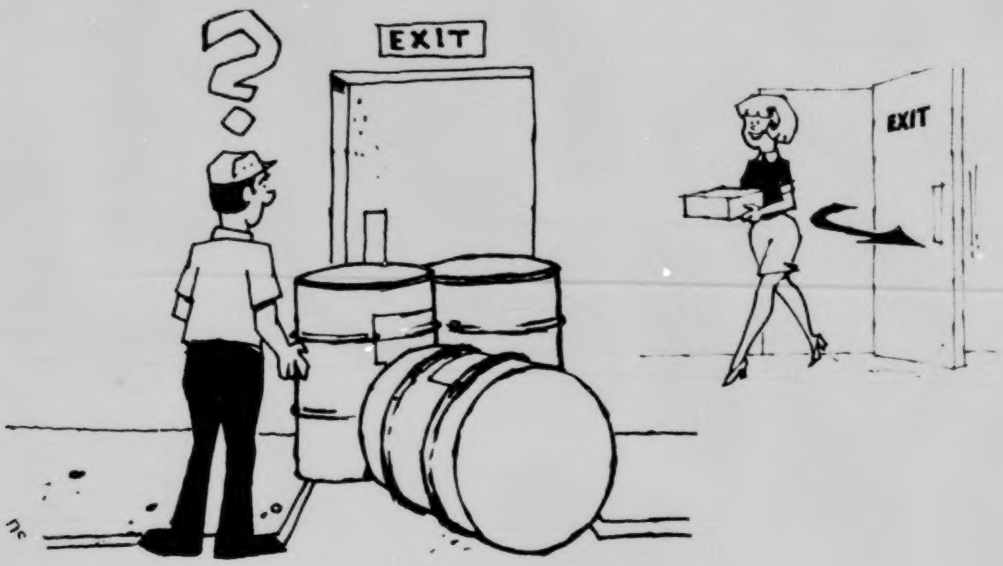
2. Areas around exit doors and passageways leading to and from the exit must be kept free of obstructions.

3. Exit access must be arranged so that it is unnecessary to travel toward any area of high hazard potential in order to reach the nearest exit (unless the path of travel is effectively shielded by suitable partitions or other barriers).

4. A door from a room to an exit, or to a way of exit access, must be of the side-hinged, swinging type. It must swing out in the direction of travel if 50 or more persons occupy the room or it is an exit from an area of high hazard potential.

5. No lock or fastening may be used which prevents escape from inside the building.

6. There must be at least two means of exit remote from each other where occupants may be endangered by the blocking of any single exit due to fire or smoke.



COLOR CODES FOR SAFETY AWARENESS

Some colors attract attention and cause a psychological reaction within most persons. Studies by consultants for paint manufacturers have shown that some colors arouse or stimulate thought; while other colors give a feeling of warmness, coolness, or relaxation, etc.

Color has been used to draw attention because of its penetration or visibility under many varying conditions. The red light used in stop signals throughout the world is a good illustration of an accepted sign or signal of danger.

OSHA regulations for color coding accept and follow some of the patterns of previous use and experience; while some of the others were arbitrarily ordered. Most of the OSHA regulations specifying the use of required colors for general use have been revoked. The following specifications are from OSHA 1910-144-Revised, November 7, 1978.

RED--shall be the basic color for the identification of:

1. Fire protection equipment and apparatus.

2. Danger. Safety cans or other portable containers of flammable liquids having a flash point at or below 80 degrees F., and table containers of flammable liquids (open cup tester)--excluding shipping containers--shall be painted red, with some additional, clearly visible identification either in the form of a yellow band around the can, or the name of the contents conspiciously stenciled or painted on the can in yellow.

   Red lights shall be provided at barricades and at temporary obstructions, as specified in ANSI Safety Code for Building Construction, A10.2-1944. Danger signs shall be painted red.

3. Stop. Emergency stop bars on hazardous machines (i.e, rubber mills, wire blocks, flat work ironers, etc.) shall be red. Stop buttons or electrical switches on which letters or other markings appear (especially those which are used for emergency stopping of machinery) shall be red.

YELLOW--shall be the basic color for designating caution and for marking physical hazards such as: striking against, stumbling, falling, tripping, and "caught between." Solid yellow and black striped, yellow and black checked (or yellow with a suitable contrasting background) should be used interchangeably, stressing the combination which will attract the most attention in a particular environment.

In addition to the color coding required for machines, equipment, and safety zones, the following coloring and lettering is required for signs that designate specific safety situations.

SPECIFICATIONS FOR ACCIDENT PREVENTION SIGNS (OSHA 1910-145)

These specifications apply to the design, application, and use of signs or symbols that are intended to indicate and, insofar as possible, define specific hazards. The hazards would be such that failure to designate them might lead to accidental injury to workers or the public, or to property damage. The specifications are intended to cover all safety signs except those designed for streets, highways, railroads, and marine regulations.

CLASSIFICATION OF SIGNS ACCORDING TO USE

DANGER SIGNS--Danger signs should be used only where an immediate hazard exists. There shall be no variation in the design of the signs posted to warn of specific dangers and radiation hazards. All workers shall be instructed that danger signs indicate immediate danger, and special precautions are necessary.

The colors red, black, and white shall be those of opaque glossy samples as specified in Table 1 of Fundamental Specification of Safety Colors for CIE Standard Source "C," American National Standard Z53.1-1967.

CAUTION SIGNS--Caution signs shall be used only to warn against potential hazards or to caution against unsafe practices.

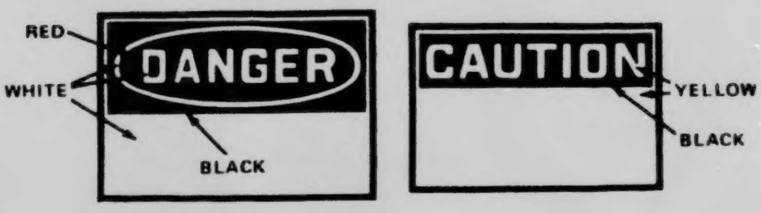
The standard color of the background shall be yellow. The panel shall be black with yellow letters. Any letters used against the yellow background shall be black. The colors shall be those of opague glossy samples as specified in Table 1 of American National Standard Z53.1-1967.

SAFETY INSTRUCTION SIGNS--Safety instruction signs shall be used where there is a need for general instructions and suggestions relative to safety measures.

The standard color of the background shall be white. The panel shall be green with white letters. Any letters used against the white background shall be black. The colors shall be those of opaque glossy samples as specified in Table 1 of American National Standard, Z53.1-1967.

All signs shall be furnished with rounded or blunt corners and shall be free from sharp edges, burrs, splinters, or other projections. The ends or heads of bolts or other fastening devices shall be located in such a way that they do not constitute a hazard. The wording of any sign shall be concise and easily read. The sign should contain sufficient information to be easily understood. The wording should make a positive, rather than a negative suggestion, and should be accurate in fact.

BIOLOGICAL HAZARD SIGNS--shall be used to signify the action or potential presence of a biohazard and to identify equipment, containers, rooms, materials, experimental animals, or combinations thereof, which contain, or are contaminated with, viable hazardous agents. For the purpose of this subparagraph, the term "biological hazard" or "biohazard" shall include only those infectious agents presenting a risk or potential risk to the well-being of man.



SPECIFICATIONS FOR ACCIDENT PREVENTION SCOPE AND PURPOSE (OSHA)

The tags are a temporary means of warning those people concerned that there is a hazardous condition, defective equipment, radiation hazards, etc. The tags are not to be considered as a complete warning method. The word "tag" refers to a surface (usually card, paper, pasteboard, or some temporary or nonpermanent material) on which letters or markings (or both) appear. These letters or markings are for warning (cautioning) those workers who may be exposed to hazards. They are to be affixed to the device by string, wire, or adhesive. The tags are not to be considered as a complete warning method, but should be used until a positive means can be employed to eliminate the hazard. They are also important in safety instruction.

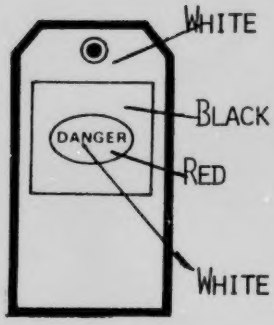
DO NOT START TAGS--The standard background color for "Do Not Start" tags shall be red. The letters shall be white, grey, or etched, provided that a long-lasting and sharp contrast results. They shall be placed in a conspicious location or in such a manner that they effectively block the starting mechanism which would cause hazardous conditions should the equipment be energized.

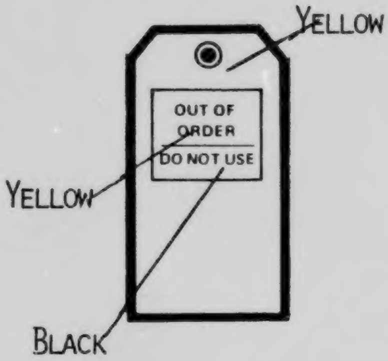
DANGER TAGS--"Danger" tags shall be used only where an immediate hazard exists. There shall be no variation in the design of the tags posted or hung to warn of specific danger. All workers should be instructed that "Danger" tags indicate an immediate danger, and that special precautions are necessary.

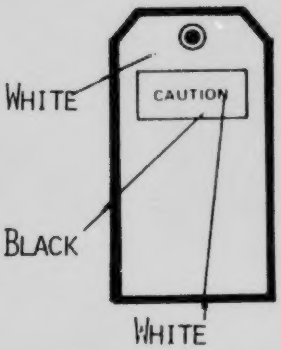
CAUTION TAGS--"Caution" tags shall be used only to warn against potential hazards or to caution against unsafe practices. All workers should be instructed that "Caution" tags indicate a possible hazard against which proper precautions should be taken.

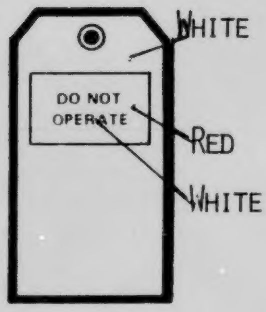
OUT OF ORDER TAGS--"Out of order" tags shall be used only for the specific purpose of indicating that a piece of equipment, machinery, etc. is out of order and to attempt to use it might present a hazard.

BIOLOGICAL HAZARD TAGS--The "Biological Hazard" tag shall be used to signify the actual or potential presence of a biohazard; and to identify equipment, containers, rooms, materials, experimental animals, or combinations thereof, which contain or are contaminated with viable hazardous agents.





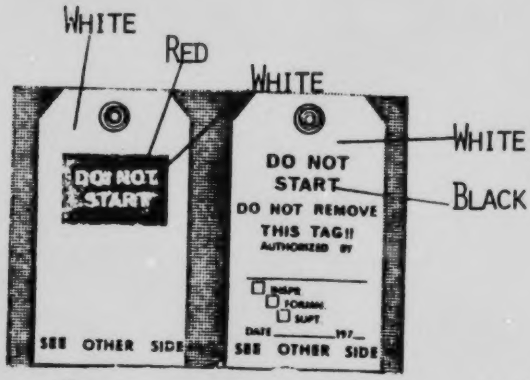




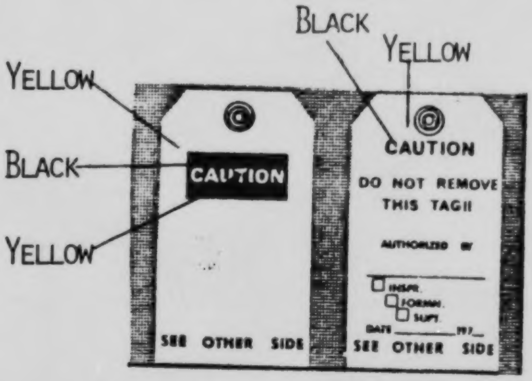
NIOSH ACCIDENT PREVENTION TAGS

TAGS (NIOSH)--Accident prevention tags differ from signs in that they are used as a temporary means of warning employees of existing hazards--such as defective tools or equipment. They may not be used in place of accident prevention tags.

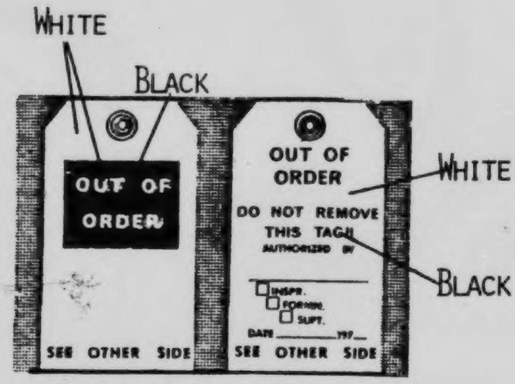
OSHA ACCIDENT PREVENTION TAGS


WHITE
RED
WHITE
WHITE
BLACK
DO NOT START
DO NOT START
DO NOT REMOVE THIS TAG!!
AUTHORIZED BY
INSPR.
FORMN.
SUPT.
DATE 197
SEE OTHER SIDE
SEE OTHER SIDE

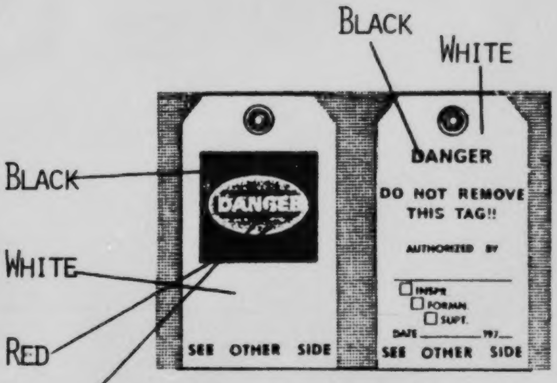
(FRONT AND BACK SHOWN)


BLACK
YELLOW
YELLOW
BLACK
YELLOW
CAUTION
CAUTION
DO NOT REMOVE THIS TAG!!
AUTHORIZED BY
INSPR.
FORMN.
SUPT.
DATE 197
SEE OTHER SIDE
SEE OTHER SIDE

(FRONT AND BACK SHOWN)


WHITE
BLACK
OUT OF ORDER
OUT OF ORDER
WHITE
DO NOT REMOVE THIS TAG!!
AUTHORIZED BY
BLACK
INSPR.
FORMN.
SUPT.
DATE 197
SEE OTHER SIDE
SEE OTHER SIDE

(FRONT AND BACK SHOWN)


BLACK
WHITE
BLACK
DANGER
DANGER
DO NOT REMOVE THIS TAG!!
AUTHORIZED BY
WHITE
INSPR.
FORMN.
SUPT.
DATE 197
RED
SEE OTHER SIDE
SEE OTHER SIDE
WHITE

(FRONT AND BACK SHOWN)

NOISE EXPOSURE

Sound, so vital a part of our existence, is growing to such disagreeable proportions within our environment that today it is a very real threat to our health. Noise pollution is a growing menace, not just to boilermakers and jackhammer operators, but to all of us. The noise level we experience daily has increased so gradually that we fail to recognize its danger. But, noise is a danger. It can result in a hearing loss that not only can be a handicap, but what is worse, a hearing loss that cannot be restored.

Sound moves through the air somewhat like waves in the ocean. In sound, the waves are alternate rings of compressed and then rarefied air moving away from a central source at a constant speed. As each wave--first a compression, then a rarefaction--encounters an object, it exerts a force--a push, then a pull-- on the object. This is why sound can break a glass or cause a window screen to vibrate.

For humans, sound has two significant characteristics: pitch and loudness. In terms of affecting people, pitch is generally an annoyance--the sound of chalk scraped over a blackboard surface. Pitch is the height or depth of a tone or sound depending on the relative rapidity of the vibrations by which it is produced. In low-pitched sounds, the vibrations are relatively far apart. In high-pitched sounds, they are squeezed closer together.

Loudness, on the other hand, can affect our ability to hear. It is the intensity of the sound waves combined with the reception characteristics of the ear. The intensity of a sound wave may be compared with the height of an ocean wave. In terms of sound's effect, this intensity is how hard a sound wave hits an object--a characteristic which can be measured precisely with instruments. But, the loudness heard by a human ear is slightly different from the purely physical values. Our ears hear sound at intermediate frequencies better than sound at very low or very high frequencies.

Sound is measured by decibels. The zero on the decibel scale is on the lowest sound level that the healthy, unimpaired human ear can detect. Decibels are not linear units like miles or pounds. Rather, they are representative points on a sharply rising curve. Thus, while ten decibels is ten times more intense than one decibel, 20 decibels is 100 times more intense (10 x 10), 30 decibels is 1,000 times more intense (10 x 10 x 10) and so on. One hundred decibels, therefore, is ten billion times as intense (that is, represents ten billion times as much acoustic energy) as one decibel. The reason for such a complicated scale is simply that the human ear detects a wide range of acoustic energy. Sound levels are measured at their source; thus, their decibel rating decreases as the distance from that source increases.

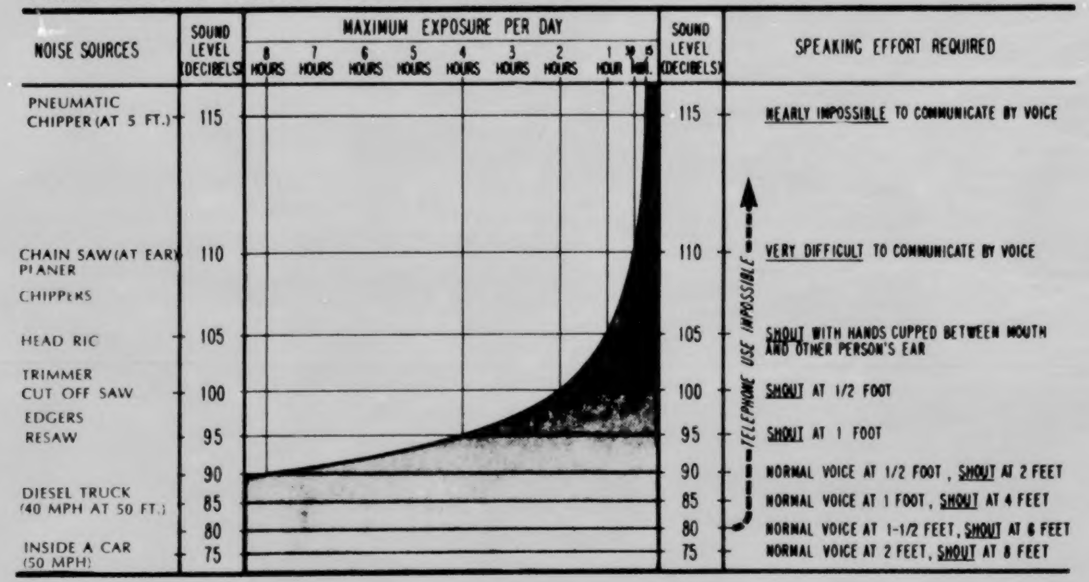
Pain occurs as the ear unsuccessfully attempts to protect itself through a mechanism physicians call "the acoustic reflex." When intense sound waves occur only briefly, the damage may be temporary. But, if loud noises are frequent or sustained, the damage may be permanent, and such noise-included hearing loss cannot be restored either through surgical procedures or hearing aids.

Scientists now tend to agree that the noise level for potential hearing loss begins at about 70 decibels. Some of them are deeply concerned because our normal daily life regularly exposes us to noise levels of about 70 decibels even inside our homes. At work, a noisy office can approach 50 decibels; a busy factory can average 85; a print shop, 95; a construction site, 100; a riveting shop, 110; a boiler factory, 118; a lumbering site, 125; and a jet runway, 130.

Clearly, something must be done soon or we will permanently maim our population with pure noise. Fortunately, the knowledge and technology to control noise already exist. As a matter of fact, this is one instance where the knowledge of control techniques exceeds the knowledge about the effects on human life and on the environment.

We have two practical means for control: (1) reduction of noise at its source, such as making the sound-producer quieter; and (2) alteration of the sound path by distance or by shielding.

PERMISSIBLE NOISE EXPOSURES



The second approach is being used more frequently today as people become more aware of the annoyance of noise. Sound-absorbant materials and construction designed to intercept sound paths are slowly coming into wider use in offices and homes.

There are many examples of available noise control technology that are not being utilized. In many cases, the cost of building quieter machines is the same or only slightly higher than that of the current noisy ones. Even though the new equipment may cost more, it can prove more profitable in the long run. Most specialists in the field agree that much of the solution must come from elimination of some of the noise at its source.

Excessive noise is one of the most commonly violated standards and can cause permanent hearing damage. To protect workers/pupils it is management's/teacher's responsibility to make sure they are not exposed to noise levels in excess of the standards.

Reference to the following table (NIOSH) gives estimates of noise levels and the maximum allowable exposure times. It is required that either engineering controls (such as enclosing noise equipment) or administrative controls (such as limiting the time of exposure) be utilized to reduce the noise level or the exposure time in order to comply with the standards. If these control measures are not feasible, then effective personal protective equipment is required. There are many forms and types of ear protection that can be considered--from ear muffs to ear plugs. Some ear protective devices are more useful than others, depending on the noise level, the frequency of the noise, and how well they fit the individual. It is necessary to provide protection that is effective and reasonably comfortable to the wearer.

A table is provided to assist in the evaluation of the noise levels in the workplace. If referral to the table indicates that the levels and time of exposure are such that corrective action is needed, it is recommended that professional help be sought to correct the problem. A noise survey by adequately equipped and trained personnel should be made before implementing engineering and administrative controls, and/or setting up a hearing conservation program.

OCCUPATIONAL NOISE EXPOSURE

Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown, as measured on the standard sound level meter.

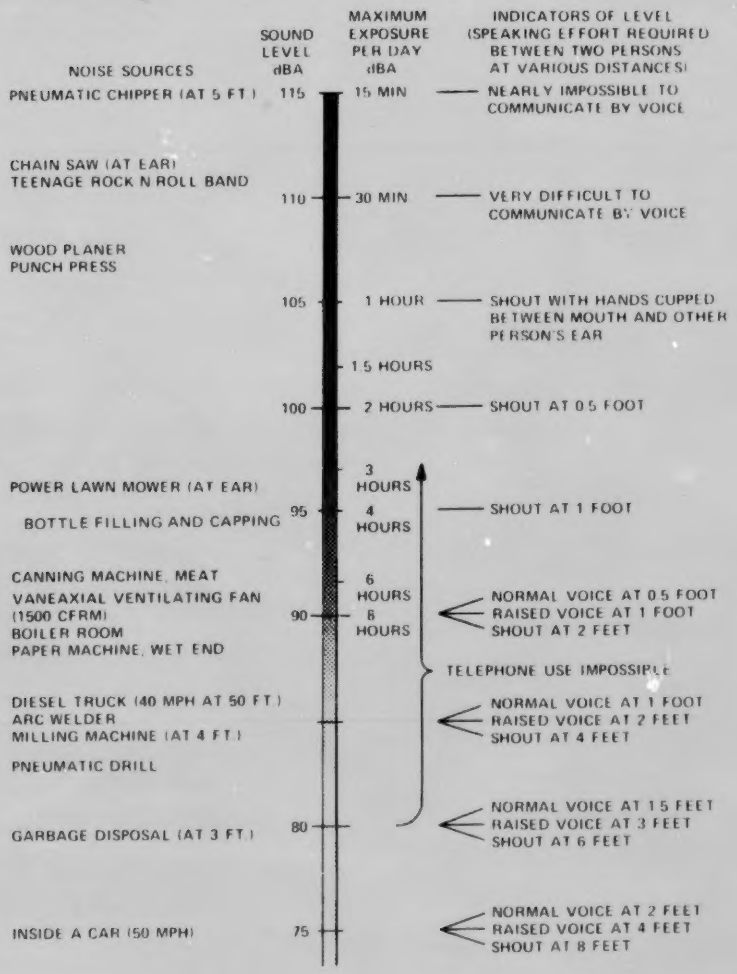
WAYS OF CONTROLLING NOISE

There are a number of ways in which noise can be controlled or diminished. They are:

CONTROL OF NOISE AT THE SOURCE--Good engineering design can eliminate much noise from worn and improperly maintained machines. Noise can also be reduced by keeping them in good operating condition. Wire mesh screens instead of sheet metal panels will reduce vibrating noisy surfaces. The linings of absorbent materials will reduce impact.

NIOSH

PERMISSIBLE NOISE EXPOSURES



SUBSTITUTION OF A LESS NOISY PROCESS--For example: spot, arc, or flame welding substituted for riveting; and belt drives instead of gears.

ISOLATION--Move noisy machines to an area where few people are working. Install well-insulated partitions and tightly closing doors.

ENCLOSURE OR BAFFLING OF THE NOISE SOURCE--Enclose or baffle the noise-producing operation in such a manner as to prevent dissipation of the noise into the surrounding air.

RESILIENT MACHINE MOUNTING--Heavy machines firmly bolted to concrete or wood floors frequently transform the floors into huge sounding boards amplifying the original noise and spreading it throughout the building. Resilient mountings of rubber or other materials isolate the machine from the floor and reduce the vibration and noise.

SOUND ABSORPTIVE MATERIALS--Hard surfaces, such as plaster and brick walls, reflect sound and cause reverberation. High frequency sounds can be absorbed by applying sound absorbents to ceilings and walls in the form of acoustical tiles, plasters, sprayed-on compositions, and blankets of porous material such as glass wool. Acoustic baffles can be hung from the ceilings.

EAR PROTECTORS--Sometimes it is impossible to sufficiently reduce the noise, even with sound control, as in the testing of jet engines. In such instances ear protection to reduce the intensity of the sound reaching the ear is necessary. Personal protection is a method of last resort. Molded and pliable earplugs, ear muffs, helmets, and ear valves are available for protection. Protection by good ear defenders is in the approximate range of 25 to 40 decibels. Use of both earplugs and ear muffs or helmets is most effective.

ROTATION OF PERSONNEL--Since the effects of sound on hearing depend partly on the length of exposure to the sound, the bad effects may be reduced by removing the worker from the noisy environment whenever audiograms indicate a hearing loss.

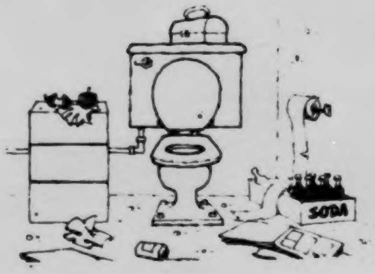
Control of noise is a complicated problem and should be undertaken only by persons qualified through knowledge and experience in this field. Otherwise, much wasted effort, both in time and money, will result.

The evaluation of hearing defects before employment can be made by giving prospective employees pure tone audiograms. Routine periodic recheck audiograms should be made on all personnel working in areas having high noise levels. A person should be removed from a high noise area if any change is noted. A hearing loss is considered permanent only if it persists after the person has been removed from the noisy area for six months. Trained personnel under the supervision of a physician may measure the hearing, but it's the responsibility of the physician to determine and evaluate the degree of hearing loss.

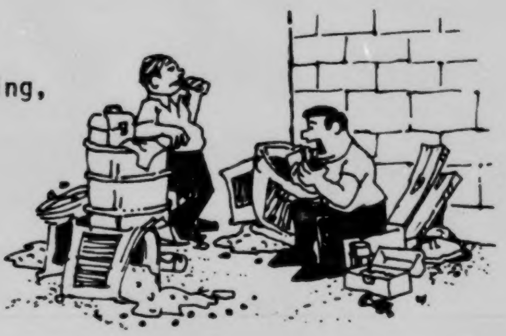
SANITATION AND FOOD INGESTION

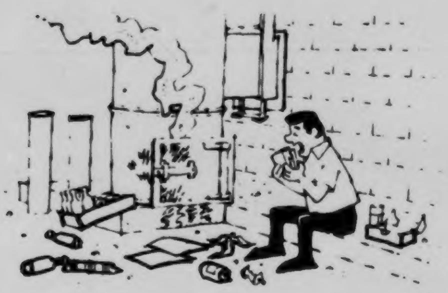
(NIOSH/OSHA)

1. Food and beverages shall not be stored or consumed in a toilet facility or in an area exposed to materials that are hazardous if ingested.



2. Waste receptacles for food shall be covered and kept in a clean and sanitary condition.
3. Restrooms shall be kept clean and sanitary, including covered containers for sanitary napkins.
4. Employees working with hazardous substances must wash and remove contaminated clothing before eating, drinking, or smoking.





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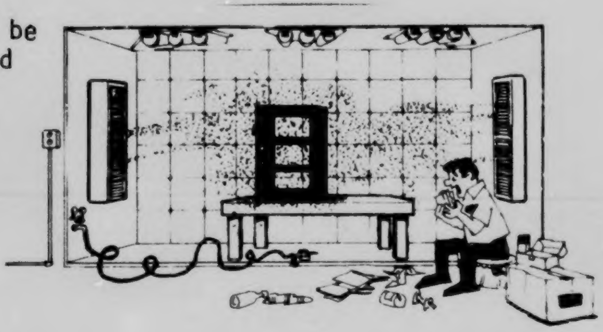
5. Safe drinking water shall be provided in all places of employment. The use of a common drinking cup is forbidden.
6. No food or beverage shall be consumed in a contaminated atmosphere.



7. Separate toilet facilities shall be provided for each sex; unless only one person at a time uses the facility, and the door can be locked from the inside.
8. One toilet and one lavatory shall be provided for approximately every 15 employees/pupils.
9. Each lavatory shall have hot and cold, or tepid, running water; hand soap; individual hand towels; or warm air blowers.
10. Waste disposal receptacles constructed of smooth, corrosion-resistant, easily cleanable, or disposable materials, shall be provided and used for the disposal of waste food. The number, size, and location of such receptacles shall encourage their use and not result in overfilling. They shall be emptied not less than once each working day, unless unused; and shall be maintained in a clean and sanitary condition. Receptacles shall be provided with a solid, tight-fitting cover unless sanitary conditions can be maintained without the use of a cover.
11. Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products, or other ingestible products, are prohibited in regulated areas.

Personal Hygiene: Food Handlers

OSHA Standard FOOD HANDLING:

> "All employee food service facilities and operations shall be carried out in accordance with sound hygiene principles. In all places of employment where all or part of the food service is provided, the food dispensed shall be wholesome, free from spoilage and shall be processed, prepared, handled, and stored in such a manner as to be protected against contamination."

Most states, cities, and/or counties require that food workers take a short course on food handling. Food service workers who prepare and serve food to customers must maintain high standards of personal cleanliness to aid in eliminating germs from spreading to customers.

RULES TO FOLLOW FOR THE FOOD SERVICE WORKER:

1. Always wear clean undergarments, outer garments, aprons, and/or uniforms.
2. Wash your hands properly with soap and water when:
   - you begin work
   - you handle food
   - after going to restroom
   - after handling raw, unwashed food
   - after mopping
   - after using handkerchief.
   - after eating
   - after smoking
   - after handling garbage or trash cans
   - after coughing, sneezing, or touching hair or facial area for any reason
3. Wear moderate or no jewelry.
4. Keep fingernails clean, short and free of nail polish.
5. Take daily baths and use antiperspirant.
6. Shampoo hair often and restrain hair with a net or cap.
7. Report skin and body infections to supervisor and work only when free of disease, illness, cuts, sores or wounds.
8. Respect smoking regulations.
9. Brush teeth twice daily.
10. Have regular physical checkups.

SANITATION PROGRAM FOR FOOD SERVICE OPERATION

1. PERSONNEL

   a. Wash hands thoroughly before entering food production area.
   b. Proper hair restraints must be worn while in food production area. (X)
   c. All employees are to practice good hygienic responsibilities.(X)
   d. Fingernails should be kept short and clean. (X)
   e. A proper washable uniform must be worn. (X)
   f. Avoid touching face and hair while working with food. (X)

2. EQUIPMENT

   a. All kitchenware and food-contact surfaces of equipment clean to sight and touch. (X)
   b. Grills and similar cooking devices cleaned daily. (X)
   c. Non-food-contact surfaces of equipment kept clean. (X)
   d. Food-contact surfaces of equipment used for potentially hazardous foods sanitized. (X)
   e. Make sure cleaned and sanitized equipment are properly stored and handled. (X)

3. FOOD PRODUCTION

   a. Protect all food from contamination by proper preparation and storage. (X)
   b. Do not re-serve unwrapped and potentially hazardous foods. (X)
   c. Wash all fruits and vegetables thoroughly. (X)
   d. Cook all food to proper temerature. (X)
   e. Minimize handling of food by use of proper utensils. (X)
   f. Thaw frozen foods only by refrigeration, radar range or by holding under cold water. (X)
   g. Make sure all potentially hazardous foods are kept 45° for below or 140° for above. (X)

4. FOOD SERVICE

   a. Store frozen dessert dippers properly. (X)
   b. Serve sugar in closed dispensers or individual packages. (X)
   c. Make sure all tableware is clean to sight and touch. (X)
   d. All tableware is to be sanitized. (X)
   e. Use all single-service items just once then discard.
   f. All utensils are to be pre-flushed, scraped or soaked. (X)
   g. Make sure all utensils are in good repair. (X)

5. HOUSEKEEPING

a. Keep kitchen and surrounding area clean from litter.(X)
b. Scrub floors. (X)
c. Wash down walls. (XX)
d. Make sure all soiled linen is put in the proper place. (X)
e. Keep trash containers emptied. (X)
f. Clean all refrigerators. (XX)
g. Keep trash containers cleaned. (XX)
h. Keep trash bin area cleaned. (XX)
i. When you see anything dirty, even if it is not part of your job, if you have time, clean it. (X)

(X)	Daily
(XX)	Weekly
(XXX)	Monthly

Sanitation: Dishwashing

Two processes are involved in the cleaning of all equipment.

1. Soil removal - removing any dirt, food particles, or other materials from equipment.
2. Sanitizing - removal of most microorganisms is accomplished through heat or chemical action.

SOIL REMOVAL IS ACCOMPLISHED BY:

1. Using a detergent with water.
2. Wiping, washing or brushing away grime, soil, or food.

SANITIZING IS ACCOMPLISHED BY:

1. Heat, 170° F or 77° C or above.
2. Chemicals
   - Chlorine
   - Iodine
   - Quats compounds

Washing Dishes Properly By Hand

1. Scrape and stack soiled dishes.
2. Wash thoroughly inside and outside in hot water, 110° F - use a recommended detergent sanitizer.
3. Rinse dishes in hot water, 170° to 180° F - and use a recommended sanitizing agent.
4. Air dry when possible.
5. Store on clean shelves upside down or covered.

Washing Dishes By Machine

The dishwasher operator must have a knowledge of the machine's mechanical abilities, detergents, water temperatures, and possible causes of failure. It has the capacity to clean and sanitize better than handwashing.

In order for the dish machine to work properly:

1. Water temperature must be correct; wash 140° F - 160° F. and rinse 170° F - 190° F.
2. Water must be changed in the tanks frequently.
3. Wash and rinse sprays must be clean.
4. Tablewear must be presoaked or scraped before washing.
5. Proper detergents and water softeners should be used.

Order is necessary to prevent breakage and to get work done efficiently.

1. Sort dishes according to size and shape and place in different stacks.
2. Silverware is placed in presoak solution.
3. Cups and glasses should be placed upside down in racks.
4. All of one kind of dish should be loaded together in the same rack for best results.
5. Pre-rinse dishes of heavy food particles.
6. Silverware should be loaded in silverware racks with eating ends up. Knives and forks should be mixed with spoons so spoons don't nest.
7. Silverware racks should be loaded loosely.
8. When silverware comes out of machine, allow it to air dry a few minutes, then unload onto a clean, dry cloth. It can then be sorted by picking up handles.

Proper Ways to Grasp Equipment to Lessen Contamination

Utensils by handle
Glasses by base
Cups by handle
Flatware by handle
Plates by outside rims

Sanitation: Food Preparation

Bacteria are all around us-on equipment, on supplies, on your body, your hands, face, hair and clothes.

In order to grow and reproduce rapidly bacteria needs:

1. The right temperature, 40° - 120° F.
2. Moisture
3. Food

High temperatures; over 170° F will kill most bacteria.

Cold temperatures; 32° - 40° F will slow down growth.

Freezing temperatures; below 32° F will stop but *not* kill bacteria growth.

The human body is 98.6° F and therefore is an ideal growth area for bacteria.

Foods themselves are not dangerous. The way in which they are handled can make them dangerous. Good sanitation practices can prevent the conditions which cause bacteria to grow and multiply.

TASTING FOOD PROCEDURE

1. Place first spoon into food.
2. Remove food.
3. Place food in second spoon.
4. Taste food away from cooking area.
5. Discard spoon used to taste, may reuse first spoon.

Sanitation: Food Preparation

TERMS

Potentially hazardous	- perishable food that supports quick growth of harmful bacteria.
Danger zone	- temperature between 45° F - 140° F.
FIFO	- First In First Out, food received first should be used first.
Batch cookery	- cook in small quantities.
Dry storage	- storage areas for canned goods, staples, and paper goods.

SOME POTENTIALLY HAZARDOUS FOODS

Milk/milk products

Eggs

Meat

Poultry

Fish

Shellfish

Sanitation: Food Preparation

For safe food service, the kitchen personnel should put into practice the following rules.

1. Get foods hot as quickly as possible and keep them hot, 140° F or over.
2. Get foods cold as quickly as possible and keep them cold, 40° F or below.
3. Keep foods covered as much as possible.
4. Use clean utensils.
5. Purchase inspected meats.
6. Exercise caution when using leftovers.
7. Wash all fresh fruits and vegetables.
8. Purchase pasteurized milk.
9. Do not prepare too much food ahead.
10. Do not expose food to the danger temperatures of 40° - 140° F for more than 3 hours.
11. Do not refreeze thawed meat, fish, or vegetables.
12. Make sure bent cans have not been punctured.
13. Check all fish and shellfish for freshness when they arrive.
14. Cook pork thoroughly.
15. Dispose of all garbage, rubbish, etc., promptly.
16. If ever in doubt about any food - throw it away.

Sanitation: Insect/Pest/Rodent Control

Common kitchen pests and their homes:

FLIES	ROACHES	ANTS
Rotting fruits/vegetables	Standing water	Sweet foods/juices
Garbage cans	Pipe/drains	Meat
Outside areas	Dark areas	
Waste areas		

RODENTS	MOSQUITOS
Decaying foods	Drains
Rubbish/trash piles	Barrels

These pests pick up germs on their bodies and feet from garbage and waste. As they travel to food the germs are left behind. Control measures can eliminate pests from storage and food service areas.

METHODS OF PEST CONTRAOL

1. Remove spoiled fruits and vegetables from kitchen.
2. Discard all spoiled foods by:
    - placing in covered container
    - placing in incinerator
    - using heavy duty disposal
3. Remove any standing water.
4. Clean counter tops and crevices regularly.
5. Clean drains daily.
6. Keep lids on garbage and trash containers.
7. Keep doors and windows closed and screened.
8. Report any structural maintenance problem to supervisor.

9. Rat/Mice proof buildings by:

    - close all small openings
    - put ratguards on wires and pipes coming into the building
    - make sure joints at walls and foundations have no cracks

10. Place outside trash containers as far from establishment as possible.

11. Watch for pests being brought into the establishment in sacks, cartons, boxes, etc.

12. KEEP ALL ANIMALS OUT.

13. Use sprays, insecticides, etc., cautiously, remember they can be harmful to food.

14. hire professional people for control.

15. KEEP EVERYTHING CLEAN!

Sanitation: Linen and Laundry

Bacteria can live and grow on textile fabrics, especially those that are not laundered at high temperatures. These bacteria can cause skin lesions, pneumonia, and infections of all kinds. They can be transferred from articles of clothing during laundering.

Extremely hot wash temperatures provide the best way of killing these bacteria. Since many home wash temperatures do not reach the required 212° F for sterilization, the home laundry method could include some of these alternatives.

1. Add a disinfectant directly to the wash or rinse cycle.
2. Hang clothing outdoors when possible to dry.
3. Wash clothing often.
4. Send some articles to industrial laundry periodically for sterilization.
5. Never store soiled clothing without washing or cleaning first.
6. Fold and store linen and laundry immediately upon completion of dryer cycle.

Sanitation: Food Poisoning

Food poisoning happens when germs multiply in food and create poisonous substances. Good sanitation practices help keep food free from harmful microorganisms so it is safe to eat. Food that has been contaminated can carry these mocroorganisms into your body. Microorganisms are difficult to identify because most of them cannot be seen without the aid of a microscope. Microorganisms are divided into these categories:

BACTERIA - the most harmful group because they are the hardest to see or identify. The following are those most dangerous.

1. Staphylococcus (staph)
2. Streptococcus (strep)
3. Salmonella
4. Perfringens
5. Botulism

MOLD - easier to identify. It's characteristics are slightly mosslike surface spots usually greenish-gray, gray, or blue-gray.

YEAST - contamination will vary. It can usually be detected by a sour smell and bubbles with clear centers on the surface of a usually smooth product.

VIRUSES - use food as a means of transportation to the next living creature. They do not infect the food.

ILLNESSES OF FREQUENT OCCURRENCE

NAME OF ILLNESS	CAUSATIVE AGENT	FOODS USUALLY INVOLVED	HOW INTRODUCED INTO FOOD	PREVENTATIVE OR CORRECTIVE PROCEDURES
Staphylococcus Food Poisoning	Staphylococcus entero-toxin-a poison developed by staphylococcus when it grows in food	Cooked ham or other meat, chopped or comminuted food, cream filled or custard pastries, other dairy products, Hollandaise sauce, bread pudding, potato salad, chicken, fish, and other meat salads, "warmed-over" food	Usually food handlers through nasal discharges or purulent local skin infections (Acne, pimples, boils, scratches and cuts)	Refrigerate moist foods during storage periods; minimize use of hands in preparation. Exclude unhealthy food handlers (having pimples, boils, and other obvious infections)
Perfringens Food Poisoning	Clostridium perfringens	Meat which has been boiled, steamed, braised, or partially roasted, allowed to cool several hours and subsequently served either cooled or reheated	Natural contaminate of meat	Rapidly refrigerate meat between cooking and use
Salmonellosis	Over 800 types of Salmonella Bacteria, capable of producing gastrointestinal illness	Meat and poultry, comminuted foods, egg products, custards, shell fish, soups, gravies, sauces, "warmed-over" foods	Fecal contamination by food handlers. Raw contaminated meat and poultry, liquid eggs and unpasteurized milk	By good personal habits of food handlers; sufficient cooking and refrigeration of perishable foods. Eliminate rodents and flies
Salmonellosis a)Typhoid Fever b)Para-typhoid A	Salmonella typhosa S. paratyphi A	Moist foods, dairy products, shell fish, raw vegetables and water	By food handlers and other carriers	Prohibit carriers from handling food; require strict personal cleanliness of food preparation; eliminate flies

ILLNESSES OF LESS FREQUENT OR RARE OCCURRENCE

NAME OF ILLNESS	CAUSATIVE AGENT	FOODS USUALLY INVOLVED	HOW INTRODUCED INTO FOOD	PREVENTATIVE OR CORRECTIVE PROCEDURES
Streptococcus Food Infection (Beta type Scarlet Fever & Strep Throat)	Beta hemolytic Streptococci	Foods contaminated with nasal or oral discharges from case or carrier	Coughing, sneezing or handling	Exclude food handlers with known strep infections
Streptococcus Infection (Alpha type) (Intestinal)	Enterococcus group; Pyogenic group	Foods contaminated with excreta on unclean hands	By unsanitary food handling	Same as above; thorough cooking of food and refrigeration of moist food during storage periods
Botulism	Toxins of Clostridium botulinum	Improperly processed	Soil and dirt. Spores not destroyed by pressurized tempertures.	Pressure cook canned foods; cook foods thoroughly after removing before serving; discard all foods in swollen unopened cans
Bacillary Dysentery (Shigellosis)	Shigella Bacteria	Foods contaminated with excreta on unclean hands	By unsanitary food handling	Strict personal cleanliness in food preparation; refrigeration of moist foods. Exclude carriers
Amoebic Dysentery	Endamoeba histolytica	Foods contaminated with excreta on unclean hands	By unsanitary food handlers	Protect water supplies; insure strict personal cleanliness with food handlers. Exclude carriers
Trichinosis	Larvae of Trichinella spiralis	Raw or insufficiently cooked pork or pork products	Raw pork from hogs fed uncooked infected garbage	Thoroughly cook pork and pork products over 150^{o}, perferably to 160^{o}
Fish Tape Worm	Parasitic Larvae	Raw or insufficiently cooked fish containing live larvae	Fish infested from contaminated water	Cook fish thoroughly. Avoid serving raw fish

Illnesses of Less Frequent or Rare Occurrence

NAME OF ILLNESS	CAUSATIVE AGENT	FOODS USUALLY INVOLVED	HOW INTRODUCED INTO FOOD	PREVENTATIVE OR CORRECTIVE PROCEDURES
Arsenic, Fluoride, Lead Poisoning (Insecticides, Rodenticides)		Any foods accidentally contaminated	Either during growing period or accident in kitchen	Thoroughly wash all fresh fruits and vegetables when received; store insecticides and pesticides away from food; properly label containers; follow use instructions; use carefully; guard food from chemical contamination
Copper Poisoning	Copper food contact surfaces	Acid foods and carbonated liquids	Contact between metal and acid food or carbonated beverage	Prevent acid foods or carbonated liquids from coming into contact with exposed copper
Cadmium and zinc poisoning	Metal plating on food containers	Fruit juices; fruit gelatin and other acid foods stored in metal plated containers	Acid foods dissolve cadmium and zinc from containers in which stored	Discontinue use of cadmium plated utensils as food containers. Prohibit use of zinc coated utensils for preparation, storage, and serving of acid fruits and other foods or beverages
Cyanide Poisoning	Silver Polish		Failure to thoroughly wash and rinse polished silverware	Discontinue use of cyanide base silver polish or wash and rinse silverware thoroughly

IMPORTANT POINTS TO REMEMBER

- Time and temperature control in storage, preparation, display and serving of foods is of utmost importance. (Hot foods hot, cold foods, cold)
- Personal hygiene and strict cleanliness in food handling is absolutely necessary to safe food service.
- Ill or infected persons should not be permitted to prepare or serve food.

Sanitation: Waste Disposal

OSHA Standard SANITATION-CONSUMPTION OF FOOD AND BEVERAGES ON THE PREMISES:

"Waste disposal containers-receptacles constructed of smooth, corrosion resistant, easily cleanable, or disposable materials, shall be provided and used for the disposal of waste food. The number, size, and location of such receptacles shall encourage their use and not result in overfilling. They shall be emptied not less frequently than once each working day, unless unused, and shall be maintained in a clean and sanitary condition. Receptables shall be provided with a solid tight-fitting cover unless sanitary conditions can be maintained without use of a cover."

1. Use adequate number of containers.
2. Be sure lids are tight.
3. For wet waste, use water tight containers.
4. Remove from kitchen as necessary.
5. Rinse and sanitize containers regularly and as necessary.
6. Provide and label separate trash containers for broken glassware and china.

Sanitation: Temperature Control of Food

FOOD	STORE AT TEMPERATURE	USE WITHIN
Beef - fresh	1° C, 30° F	1 month
Lamb/Pork - fresh	1° C, 30° F	Few days
Fish - fresh	0° C, 32° F	2-3 days
Poultry - fresh	3° C, 26° F	Few days
Milk/Dairy Products	5° C, 40° F	A week's time cheese longer
Vegetables/fruits other than Bananas	4° C, 40° F	1 day - 2 weeks depending on item
Prepared foods	4° C, 40° F	1-3 days, keep separate from raw or unprepared
Frozen foods	18° C, 0° F	3 months, oldest foods need to be used first

AIR CONTROL OF FOOD

1. Store food on pallets or shelves, NOT on floor.
2. Remove food from shipping cases when possible.
3. Report abnormal (bulging, rusting, leaking) cans to supervisor.
4. Leave 4" for air circulation between pans containing cooked foods in the refrigerator.

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Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

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VENTILATION

Mechanical exhaust ventilation is, in most cases, the first choice for control of air contaminants which are potential health hazards. A properly-designed local exhaust or dilution ventilation system will either remove any air contaminants which may be present, or will lower the concentration of fumes, vapors, dusts, mists, or other contaminants generated in the working environment. This will reduce or eliminate health or fire hazards.

Local exhaust ventilation removes the hazardous materials at or near their point of origin, and prohibits them from being drawn through the breathing zone of the worker. Local exhaust ventilation is the preferred type as it usually performs more efficiently and prevents air contaminants from being circulated through the entire work area.

General dilution ventilation depends upon pulling a sufficient volume of air through the work area to dilute the contaminants to a lower, or non-hazardous, level. Dilution ventilation requires a greater volume of air movement for efficient operation than does a local exhaust system.

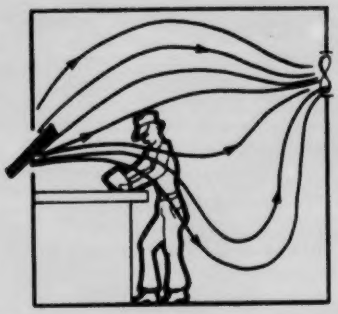
Local exhaust systems should be installed wherever a large volume of air contaminant is generated, or where a particularly hazardous substance is used.

General dilution ventilation is an effective control for areas generating low concentrations of hazardous substances. It may effectively be used in some flammable liquid storage areas or with low hazard potential substances.

The design of ventilation systems is somewhat detailed--involving a determination of the volume of air which needs to be moved, the type of fan which will adequately exhaust the air volume, the placement of the exhausts, makeup air, and the positioning of the system. A mechanical engineer should be consulted to assist in providing an effective environmental control through the use of a ventilation system.

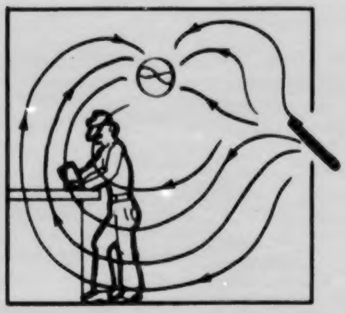
General ventilation is accomplished by introducing fresh air into laboratories at the rate of at least six air changes per hour, or in sufficient quantity to balance the air flow through stock removal and other exhaust systems. General ventilation is commonly accomplished by both blowers and exhaust systems. Air movement should not be more than 25 lineal feet per minute during the heating season, and 100 lineal feet per minute during warm weather.

GENERAL VENTILATION



POOR GENERAL VENTILATION

(CONTAMINANT IS DRIVEN INTO THE WORKER'S BREATHING ZONE AND ATMOSPHERE.)



FAIR GENERAL VENTILATION

(INCOMPLETE FLUSHING OF THE ROOM CONTAMINATION OF GENERAL ATMOSPHERE.)

Special consideration should be given to ventilation requirements for welding, foundry, forging, heat treating, machining cast iron, machine woodworking, auto mechanics, plastics forming and grinding, electroplating, etching, painting, and the making of blueprints. For many of the above operations, specially designed hoods are required.

Exhaust hoods remove air from a room. The air should be replaced at a rate equal to or slightly less than the rate at which it is removed. The required hood face velocity should vary between 100 and 150 feet per minute depending on whether the hood is used for routine operations or hazardous operations.

In the chemical laboratory, local exhaust ventilation that removes airborne contaminants at the site of generation is preferred. General dilution ventilation may be used when the concentrations of chemicals in the air are below the level that will cause injury or illness.

Exhaust ventilation, including point-of-operation ventilator hoods, is a necessity for toxic chemical operations. Inadequate ventilation provides a false sense of security. The following are some salient suggestions and considerations on ventilation:

A ventilation hood should be designed to capture the contaminant at the source. Although there is no universal type hood, the "Laboratory Style Hood" is often used. Slotted side draft hoods along the back of the bench may work well for open bench tops. Small canopy hoods may cover a piece of equipment to capture any contaminant being released by the equipment. However, they should be designed so that all persons are prevented from placing their heads between the contaminant source and the hood.

Completely enclosed hoods (glove box type) should be used for highly toxic chemicals.

VENTILATING SYSTEMS (OSHA)

DUST COLLECTOR--A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.

EXHAUST VENTILATION SYSTEM--A system for removing contaminated air from a space, comprising two or more of the following elements: (a) enclosure or hood, (b) duct work, (c) dust collecting equipment, (d) exhauster, and (e) discharge stack.

The construction, installation, inspection, and maintenance of exhaust systems shall conform to the principles and requirements set forth in American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960, and ANSI Z33.1-1961.

When dust leaks are noted, repairs shall be made as soon as possible.

The static pressure drop at the exhaust ducts leading from the equipment shall be checked when the installation is completed, and periodically thereafter to assure continued satisfactory operation. Whenever an appreciable change in the pressure drop indicates a partial blockage, the system shall be cleaned and returned to normal operating condition.

AIR CONTAMINANTS

When personnel are exposed to hazardous concentrations of airborne contaminants, exposure must be reduced to acceptable levels by either engineering or administrative methods. Respirators are acceptable controls only while engineering controls are put into effect, or if engineering controls are not mechanically feasible.

The primary methods of controlling exposure are substitution of less hazardous substances or processes and mechanical exhaust ventilation. Isolation and automation can also be used to reduce exposure to hazardous substances.

AUTOMOTIVE SHOP VENTILATION

Although large amounts of general ventilation can be used, a tail pipe exhaust system is recommended for removing auto exhaust from garages. If a person has such a system he/she should make sure it is used. He/she should also determine whether the mechanical ventilation is adequately designed. As an example, a 300 cubic inch engine exhausts about 100 cubic feet per minute (cfm) at 600 RPM.

An inspection program should be ongoing to make sure the system is performing properly.

SOLVENTS--If a considerable amount of time is spent cleaning parts, the tank should contain local exhaust ventilation and be vented to the outside.

PAINTS AND THINNERS--The thinners used in most paints will have a narcotic effect on the workers, and may, on a longer-term basis, cause irreparable illness such as liver and lung damage. In addition to ventilation in the spray area or paint booth, respirators should be worn. (See "Respirators" in Section X--Personal Protective Equipment.)

Some of the newer paints contain hardeners and other additives that can cause skin rashes and dermatitis. Workers should not be permitted to wash their hands in thinners because they take the fats out of the skin, increase the chance for skin rashes, and can, in some cases, be absorbed through the skin. Wearing rubber gloves while handling the paint will prevent this.

BODY FILLER--Plastic body fillers are the most popular type of materials used to repair auto bodies. When handling the raw materials (before they have dried or cured), rubber gloves should be worn. If any material gets on the skin, it should be promptly washed off with soap and water.

LEAD--When it is necessary to use lead as a body filler, each worker should wear a respirator to protect him/her from lead dust or fumes. Workers should also vacuum the area after use, and should not smoke or eat until they have washed their hands.

DUSTS--Dust is a problem in body shops. During dusty operations (such as sanding paints and primers, body fillers, etc.), a lot of dust is produced. At this point, the person doing the work should wear a dust mask (it can be a disposable one).

HYDROGEN--The battery charging operation produces hydrogen gas, and an explosive atmosphere may result unless ventilation is provided to carry off the gas. "NO SMOKING" signs must also be posted.

CARPENTRY AND WOODS LABORATORY VENTILATION

Contrary to the opinion that wood dust is innocuous, it may contain allergenic or biologically-active ingredients, as well as free silica. Therefore, people who work in the lumber and building materials industry might complain of irritation of the nasal mucous membranes and upper respiratory tract, inflammation and irritation of the eyes, skin allergies, and asthma-like symptoms.

A person's exposure to wood dust can be controlled by reducing the exposure time or by the use of engineering controls.

DUST CONTROL--Most dust in a woodworking production shop is removed by local exhaust systems. However, many times there is a considerable accumulation of very fine dust that has settled on rafters and other structural members - especially in areas where sanding is done. Such a situation is potentially hazardous because of the danger of fire and explosion. A flash fire over dust-covered surfaces may be followed by explosions of ever increasing force.

PREVENTING DUST EXPLOSIONS--Employers/supervisors must:

1. Not allow dust to accumulate on the equipment.
2. Control sources of ignition.
3. Install explosion vents on equipment and buildings.
4. Provide ample fire protection.
5. Instruct employees/pupils on the hazards of combustible dust.

6. Provide frequent vacuum cleaning, or the use of soft push brooms.
7. Provide continuous suction to remove fine dust in areas where sanding is performed.
8. Have a proper exhaust system piped to a suitable collector.
9. Never permit compressed air to be used to blow away potentially explosive dust.

METALS AND WELDING LABORATORY VENTILATION

After checking to see that the welding and cutting equipment is mechanically and electricaly sound, engineering and administrative controls for the contaminants produced by welding and cutting should be assessed.

DILUTION VENTILATION--For many welding and cutting operations, control by dilution ventilation will be sufficient. Enough fresh air must be added to the contaminated air so that hazardous concentrations do not develop. However, the effectiveness of dilution ventilation depends on several factors:

1. The size of the space in which the welding or cutting is done, especially the height of the ceilings,
2. The total number of welders working within the space, and
3. The hazardous chemical or physical agents produced by the welding or cutting.

Dilution ventilation is necessary whenever welding or cutting is done in a work space of less that 10,000 cubic feet per welder; in a room less that 16 feet high; in confined spaces; or where the welding space contains partitions, balconies, or other structural barriers that obstruct cross-ventilation. Otherwise, natural ventilation should be sufficient for most welding and cutting activities.

When dilution ventilation is used, it must move at least 2,000 cubic feet of air per minute per welder, unless local exhaust hoods and booths are used to control fumes where they are produced.

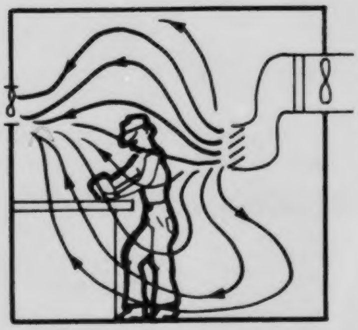
When using dilution ventilation, there are several points to keep in mind:

1. Exhaust openings should be located as close as possible to the source producing the contaminants.

2. In order to keep the contaminants out of the breathing zone of the worker, the fresh air applied to the work space should first pass through the worker's breathing zone, then across the work space where the contaminant is produced, and into the exhaust system as rapidly as possible.

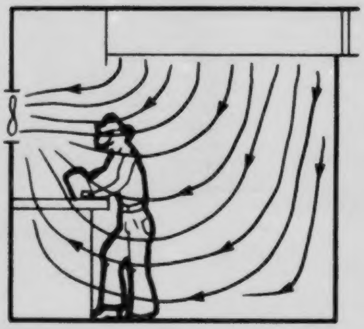
3. Unless the exhausted air is discharged far enough away from the fresh air intake duct, the fresh air can become contaminated.

Examples of possible arrangements (both good and bad) for dilution ventilation of a work space are depicted in these figures:



GOOD GENERAL VENTILATION

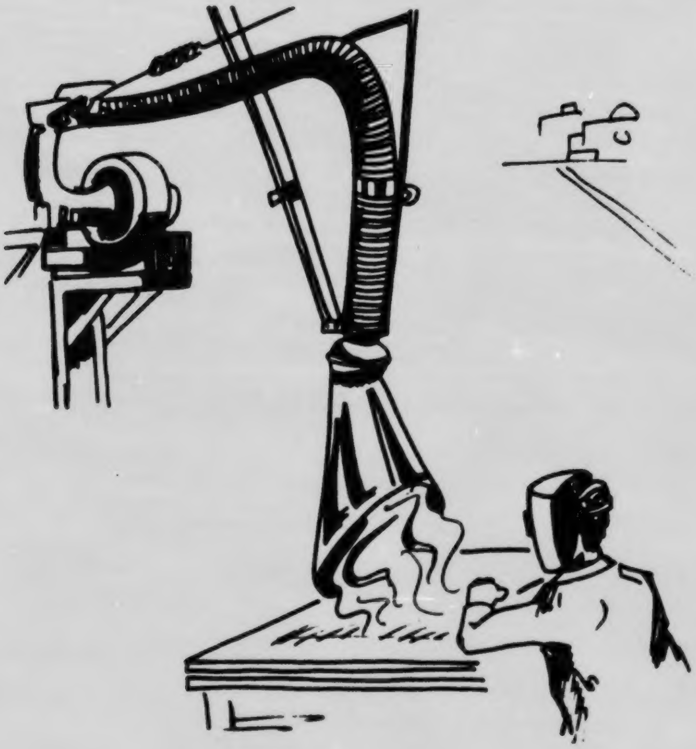
(AIR ENTERS AT BREATHING ZONE HEIGHT AND KEEPS CONTAMINATION AWAY FROM THE WORKER.)



BEST GENERAL VENTILATION

(LOW VELOSITY DIFFUSION THROUGH CEILING, CREATING AN IMMEDIATE EXHAUST OF CONTAMINATED AIR.)

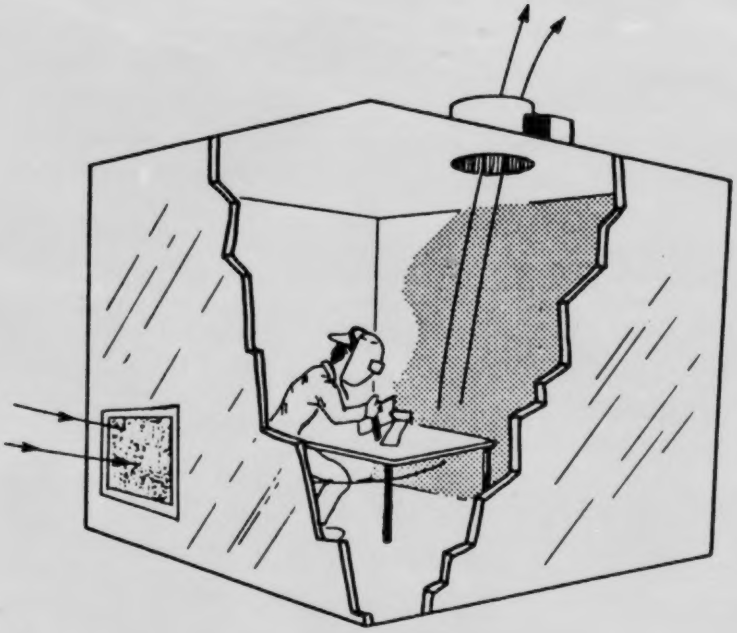
LOCAL EXHAUST VENTILATION--This is the most effective means of control for airborne contaminants produced by welding or cutting. Local exhaust ventilation can be provided by several types of equipment: freely movable hoods, fixed enclosures (booths, down-draft benches, and extractor nozzles.)



1. Freely movable hood--This consists of a movable hood attached to a fan. The fan draws air from the work space and exhausts it outdoors, either directly or through a dust collection system. The hoods are normally constructed so that they can be moved into place by the welder.

   The air handling system should move the air at least 100 feet per minute across the welding site at even the most remote point from the exhaust opening. It is important that the exhaust hood be placed as near as possible to the work being done. A freely movable hood is useless if it is not moved when the welder shifts his/her position. This form of ventilation, to be effective, is dependent on the conscious effort of the welder.

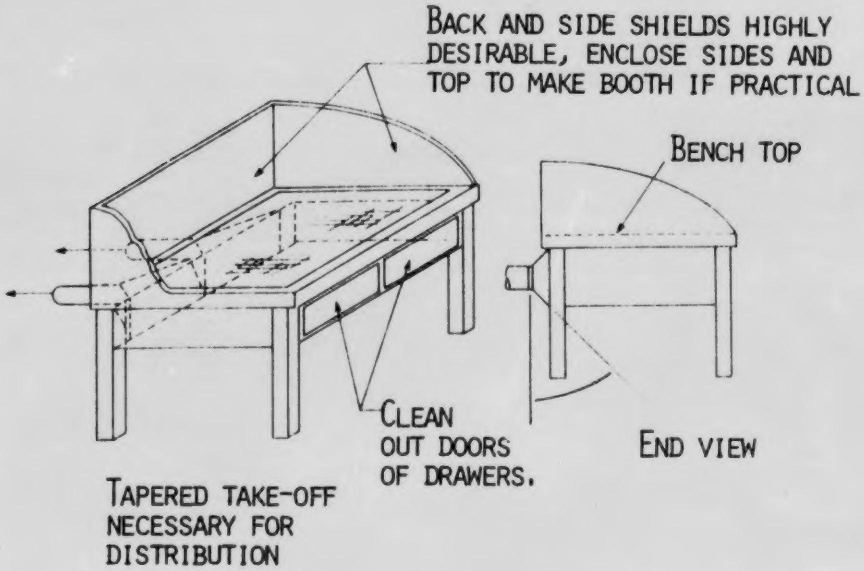
2. Fixed enclosure--Many welding or cutting operations that are done in a fixed location can be provided with a fixed enclosure. This is a structure built around the welding or cutting operation which has a top and at least two sides. A means for drawing air through the work area is provided, so that the work space is flushed continuously with fresh air.



FIXED WELDING ENCLOSURE

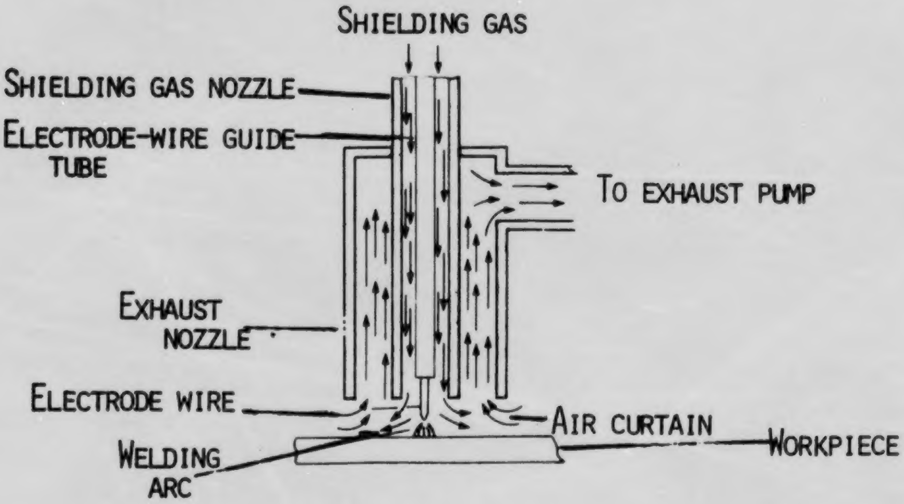
Within such an enclosure, work should be arranged and conducted in such a way that the fresh air enters the enclosure through the worker's breathing zone and then passes through the work space in which the contaminants are produced. For most fixed enclosures, the air should move at least 100 feet per minute across the entrance to the enclosure.

3. Down-draft bench--A third type of local exhaust ventilation is the down-draft bench or table. The welding or cutting is performed on a bench or table which has an open grid as the work surface. Air is drawn downward through the grid, into the duct work, and then exhausted - preferably outdoors. This prevents the contaminants from rising into the worker's breathing zone. However, to function properly, the work being done on the bench must not be of such a size that it covers most of the work surface. This would obstruct the airflow into the exhaust system.


BACK AND SIDE SHIELDS HIGHLY DESIRABLE, ENCLOSE SIDES AND TOP TO MAKE BOOTH IF PRACTICAL
BENCH TOP
CLEAN OUT DOORS OF DRAWERS.
END VIEW
TAPERED TAKE-OFF NECESSARY FOR DISTRIBUTION

TYPICAL DOWN-DRAFT BENCH

4. Extractor nozzle--A new development in local exhaust ventilation for welding is the extractor nozzle. This equipment is based on the idea that exhaust ventilation should be built into the semi-automatic welding processes (such as the metal inert gas type). In this system, a slotted exhaust chamber is installed as part of the welding equipment itself. The slotted exhaust chamber is positioned to allow the welder a clear view of the electrode. The contaminated air from around the welding operation is drawn through the chamber to an exhaust system.


SHIELDING GAS
SHIELDING GAS NOZZLE
ELECTRODE-WIRE GUIDE TUBE
TO EXHAUST PUMP
EXHAUST NOZZLE
ELECTRODE WIRE
AIR CURTAIN
WORKPIECE
WELDING ARC

FXTRACTOR NOZZLE

ADMINISTRATIVE CONTROL--If engineering controls cannot be installed, or while they are being put into effect, administrative controls may be necessary to limit exposure. Work can be scheduled so that no individual worker is exposed to airborne contaminants above the acceptable concentration or time limits. In other words, if a particular operation presents exposures above the acceptable limits (if performed full time), the exposure can be "shared" by splitting the assignment between two welders.

AIR CONTAMINANTS

Whenever drygrinding, polishing, or buffing is performed, and worker exposure exceeds the permissible exposure limits, a local exhaust ventilation system must be provided and used to maintain exposures within the prescribed limits. This requirement exists whether or not respirators are used. OSHA has established standards limiting the amount of air contaminants to which a person may be exposed. These standards are published in The Code of Federal Regulations (29 CFR 1910.1000 et seg.) entitled "General Industry Standards." Private consultants, insurance carriers, and state and federal agencies will be helpful in evaluating the workplace for health hazards and the controlling of such hazards.

REFERENCES

Materials were selected and reviewed from the following sources and in some instances were incorporated in the production of the preceding unit.

U.S. EPA - 335

NIOSH Technical Report-79-117, "Industrial Noise Control"

OSHA Publication 2206, General Industry, Safety and Health Standards.

ART STUDIO VENTILATION

One of the most important factors to consider when providing a safe studio environment is adequate ventilation. Merely having a window or door open does not provide adequate ventilation for all but the smallest amount of toxic substances. Adequate ventilation is the most important method for controlling air that has been contaminated with toxic substances.

Essentially, there are three methods or types of ventilation to consider: a window exhaust fan system, a local exhaust system, and the use of respirators. It should be noted that, of the three, the use of respirators has the most limitations, due to a number of factors. These include: no provision for skin absorption, improper face fit, deactivation by long usage, and a degree of discomfort which may tend to discourage their usage. Of the three types of ventilation listed, a local exhaust system warrants the most attention because it is the most desirable type of ventilation.

"A local exhaust system consists of an exhaust hood to trap the contaminant, a duct system to carry the contaminant to the outside, an exhaust fan, and sometimes air-cleaning equipment to prevent the toxic materials from polluting the atmosphere." (Michael McCann)

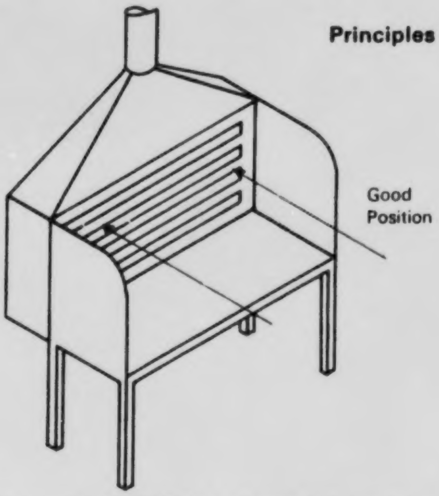
There are many factors that affect the design and place placement of an exhaust hood. In most cases, the system is usually placed along a wall and more often than not in the corner of the room. An examination of the studio room should be made to determine where the exhaust system should be placed in order to obtain the maximum amount of ventilation possible. The shape of the hood greatly affects its efficiency. Since the hood opening draws in air from all directions, enclosing the operation so that the air is drawn only from the direction desired means that less air is required.

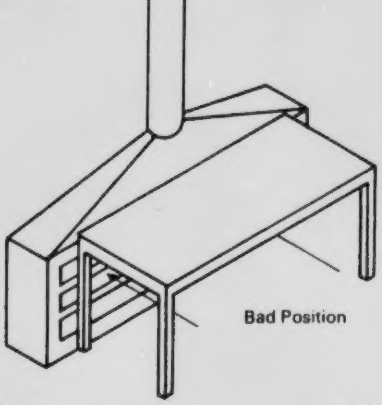
The hood should be situated in such a manner that it is as close to the contaminant being used as possible. The effectiveness of the velocity of the exhaust drops dramatically as the distance from the hood increases. The rate of the air drawing the contaminant into the system should be greater than the obvious or natural velocity of the contaminant and the air surrounding it. The location of the hood should be such that the contaminants do not pass through the breathing zone before entering the hood. Any placement contrary to this negates the purpose of the ventilation system.

In general, a metal hood and duct system is recommended, as it fulfills more completely the requirements of general studio use.

"In designing a general ventilation system, there are several factors to consider. First, make sure that there is enough made-up air entering the room to replace that which is being exhausted. Second, make sure that the air inlet and outlet are sufficiently far enough apart that there is no chance of contaminated air from the outlet getting back in. Third, design the air flow so that it reaches people before being contaminated. Finally, make sure that the air is evenly distributed throughout the room and that there are no uncomfortable drafts." (Michael McCann)

Principles of Local Ventilation

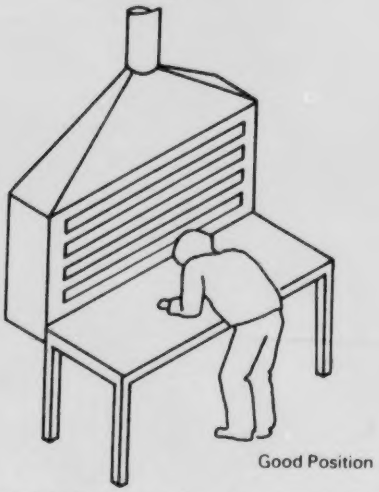




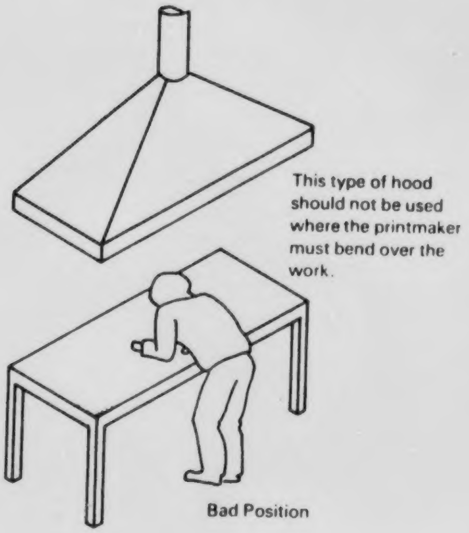
Example:

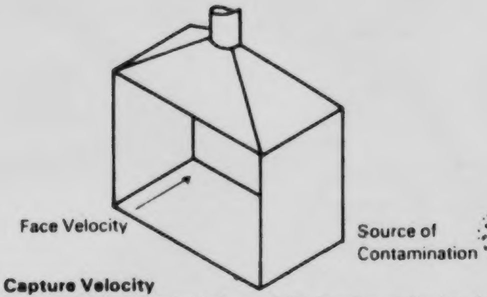
Density of air	1.0
Density of 100% amyl acetate vapor	4.49
Density of lowest explosive mixture	1.038
Density of T.L.V. mixture	1.0003

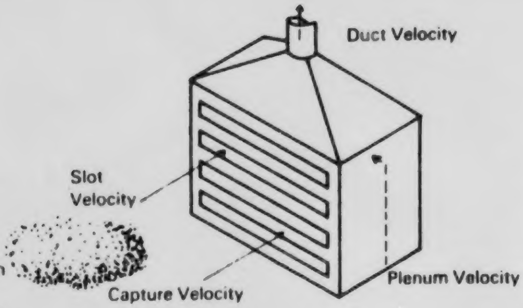
Solvent vapors in **health hazard concentrations** are not appreciably heavier than air.



Locate the hood so the contaminant is removed from the breathing zone of the printmaker.


This type of hood should not be used where the printmaker must bend over the work.


Face Velocity
Source of
Contamination


Duct Velocity
Slot
Velocity
Capture Velocity
Plenum Velocity

Capture Velocity
Air velocity at any point in front of the hood or at the hood opening necessary to overcome opposing air currents and to capture the contaminated air at that point by causing it to flow into the hood.

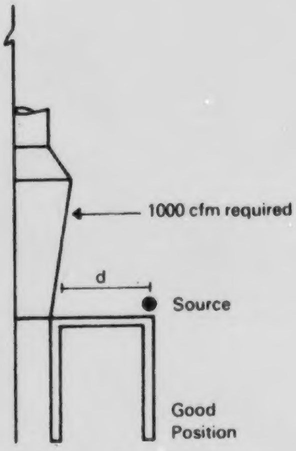
Face Velocity:
Air velocity at the hood opening.

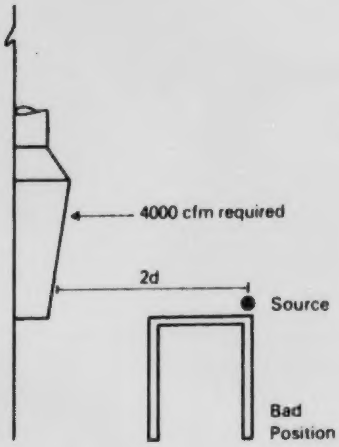
Slot Velocity:
Air velocity through the openings in a slot-type hood, fpm. It is used primarily as a means of obtaining uniform air distribution across the face of the hood.

Plenum Velocity:
Air velocity in the plenum, fpm. For good air distribution with slot type hoods, the maximum plenum velocity should be ½ of the Slot Velocity or less.

Duct Velocity:
Air velocity through the duct cross section, fpm. When solid material is present in the air stream, the duct velocity must be sufficient to carry the particles.

fpm — feet per minute


1000 cfm required
d
Source
Good
Position


4000 cfm required
2d
Source
Bad
Position

Place hood as close to the source of contamination as possible. The required volume of air increases with the square of the distance from the source.

cfm = cubic feet per minute d = distance

Reference: Michael McCann, Health Hazards Manual for Artists, pub. The Foundation for the Community of Artists, 1975.

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

Michael McCann, Health Hazards Manual for Artists, P. 17-20, pub. by The Foundation for the Community of Artists, 1975.

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FLAMMABLE AND COMBUSTIBLE LIQUIDS

DEFINITIONS

AEROSOL--A material which is dispensed from its container as a mist, spray, or foam by a propellant under pressure. (OSHA)

ATMOSPHERE TANK--A storage tank which has been designed to operate at pressures from atmospheric through 0.5 psig. (OSHA)

BOILING POINT--The point of a liquid at a pressure of 14.7 pounds per square inch absolute (psia) (760 mm).

FLASH POINT--The minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. (OSHA)

FLAMMABLE LIQUID--Any liquid having a flash point below 100 degrees Fahrenheit. (37.8 degrees C.)

COMBUSTIBLE LIQUID--Any liquid having a flash point at or above 100 degrees Fahrenheit (37.8 degrees C.).

PORTABLE TANK--A closed container having a liquid capacity over 60 U.S. gallons and not intended for fixed installations. (OSHA)

SAFETY CAN--An approved container of not more than five gallons capacity, having a spring closing lid and so designed that it will safely relieve internal pressure when subjected to fire exposure. (OSHA)

BARREL--A volume of 42 U.S. gallons. (OSHA)

CONTAINER--Any can, barrel, or drum. (OSHA)

APPROVED CONTAINERS--"Approved" by Underwriters Laboratories, Inc. or Factory Mutual Engineering Corporation unless otherwise indicated. (OSHA)

CLASSIFICATION OF FLAMMABLE LIQUIDS

Flammable and combustible liquids are divided into three classes. Class I liquids are subdivided into three groups.

CLASS I liquids are subdivided as:

CLASS IA includes those liquids having flash points below 73 degrees F (22.8 degrees C.) and having a boiling point below 100 degrees F (37.8 degrees C.).

CLASS IB shall include those having flash points below 73 degrees F (22.8 degrees C.) and having a boiling point at or above 100 degrees F (37.8 degrees C.).

CLASS IC shall include those having flash points at or above 73 degrees F (22.8 degrees C.) and below 100 degrees F (37.degrees C.).

COMBUSTIBLE LIQUIDS shall be subdivided as follows:

CLASS II liquids shall include those having flash points at or above 100 degrees F (37.8 degrees C) and below 140 degrees F (60 degrees C.).

CLASS IIIA liquids shall include those having flash points at or above 140 degrees F (60 degrees C) and below 200 degrees F (93.4 degrees C.).

CLASS IIIB liquids shall include those having flash points at or above 200 degrees F (93.4 degrees C.).

NOTE: If a flammable liquid is only 1% or less of a mixture whose other components have flash points above 100 degrees F, the mixture is not a flammable liquid.

NOTE: If a combustible liquid is only 1% or less of a mixture whose other components have flash points above 200 degrees F, the mixture is not a combustible liquid.

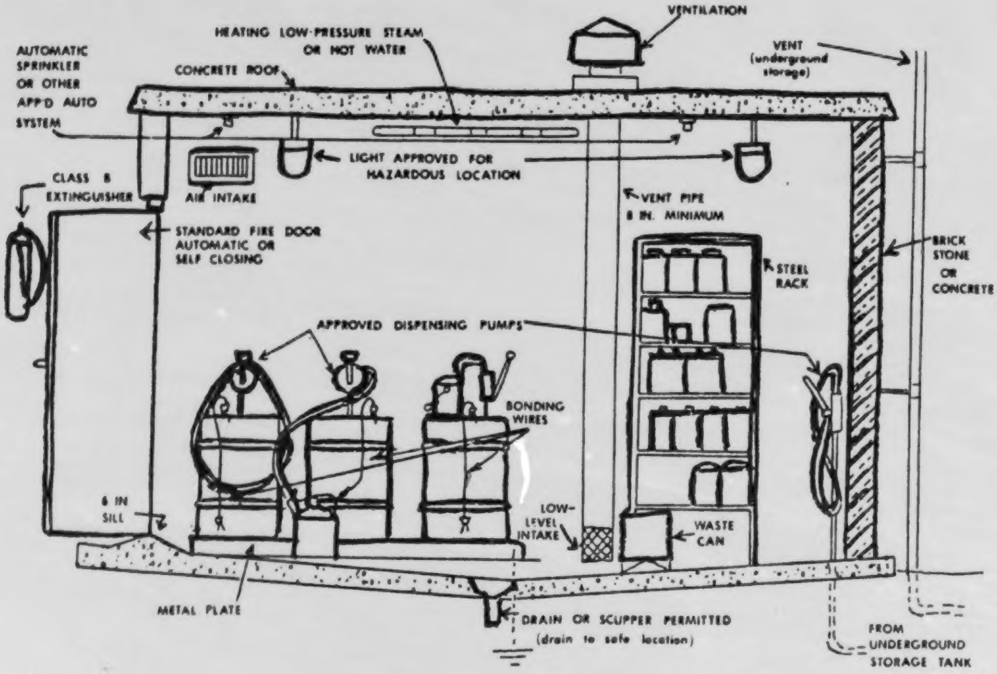
EXAMPLES OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

CLASSIFICATION OF SOME TYPICAL FLAMMABLE AND COMBUSTIBLE PRODUCTS

Class		FLAMMABLES	Flash Point	Boiling Point
	A	Gasoline (some) Pentane	Lower than 73°F	Lower than 100°F
I	B	Acetone Denatured Alcohol Gasoline (some) Naphtha, VM and P Toluene	Lower than 73°F	At or Above 100°F
	C	Xylene	At or Above 73°F	
II		COMBUSTIBLES Kerosene Mineral Spirits Naphtha Stoddard Solvent	At or Above 100°F	
III		Asphalt Brake Fluid Fuel Oil #4 Fuel Oil #5 Fuel Oil #6	At or Above 140°F	

TAKEN FROM NIOSH: OCCUPATIONAL SAFETY AND HEALTH IN VOCATIONAL EDUCATION

STORAGE: INSIDE ROOMS


VENTILATION
HEATING LOW-PRESSURE STEAM OR HOT WATER
AUTOMATIC SPRINKLER OR OTHER APP'D AUTO SYSTEM
CONCRETE ROOF
VENT (underground storage)
LIGHT APPROVED FOR HAZARDOUS LOCATION
CLASS B EXTINGUISHER
AIR INTAKE
VENT PIPE 8 IN. MINIMUM
STANDARD FIRE DOOR AUTOMATIC OR SELF CLOSING
STEEL RACK
BRICK STONE OR CONCRETE
APPROVED DISPENSING PUMPS
BONDING WIRES
6 IN SILL
LOW-LEVEL INTAKE
WASTE CAN
METAL PLATE
DRAIN OR SCUPPER PERMITTED (drain to safe location)
FROM UNDERGROUND STORAGE TANK

STORAGE: INSIDE ROOMS (CONTINUED)

1. Open flames and smoking shall not be permitted in flammable or combustible liquid storage areas. (OSHA) (NIOSH)

2. Openings to other rooms or buildings shall be provided with self-closing fire doors and noncombustible, liquid-tight, raised sills or ramps at least four inches high. A permissible alternative to a sill or ramp is an open-grated trench which drains to a safe location. (NIOSH)

3. General exhaust ventilation (either gravity or mechanical) which provides for a complete air change within a room at least six times each hour is required for inside storage rooms. Roof vents are important. (OSHA) (NIOSH)

4. Explosion-proof lights are required in flammable liquid storage areas. (OSHA)

5. Storage shall never be near exits, stairways, or areas normally used for the safe egress of people. (OSHA)

6. "No Smoking" signs shall be posted. (OSHA)

7. The quantity of liquid that may be located outside of an inside storage room or storage cabinet in a building or in any one fire area of a building shall not exceed:

   A. 25 gallons of Class 1A liquids in containers.

   B. 120 gallons of Class 1B, 1C, II, or III liquids in containers.

   C. 660 gallons of Class 1B, 1C, II, or III liquids in a single portable tank. (OSHA)

STORAGE IN INSIDE ROOMS

Fire protection* provided	Fire resistance	Maximum size	Total allowable quantities (gals./sq. ft. floor area)
Yes	2 hours	500 sq. ft.	10
No	2 hours	500 sq. ft.	4
Yes	1 hour	150 sq. ft.	5
No	1 hour	150 sq. ft.	2

*FIRE PROTECTION SYSTEM SHALL BE SPRINKLER, WATER SPRAY, CARBON DIOXIDE, OR OTHER SYSTEM.

NIOSH: HEALTH AND SAFETY GUIDE FOR AUTO AND HOME SUPPLY STORES

INDOOR CONTAINER STORAGE

Class liquid	Storage level	Protected storage Maximum per pile		Unprotected storage Maximum per pile	
		Gallons	Height	Gallons	Height
I-A	Ground and upper floors	2,750 (50)	3 ft. (1)	660 (12)	3 ft. (1)
	Basement	Not permitted		Not permitted	
I-B	Ground and upper floors	5,500 (100)	6 ft. (2)	1,375 (25)	3 ft. (1)
	Basement	Not permitted		Not permitted	
I-C	Ground and upper floors	16,500 (300)	6 ft. (2)	4,125 (75)	3 ft. (1)
	Basement	Not permitted		Not permitted	
II	Ground and upper floors	16,500 (300)	9 ft. (3)	4,125 (75)	9 ft. (3)
	Basement	5,500 (100)	9 ft. (3)	Not permitted	
III	Ground and upper floors	55,000 (1,000)	15 ft. (5)	13,750 (250)	12 ft. (4)
	Basement	8,250 (450)	9 ft. (3)	Not permitted	

NOTE 1: When 2 or more classes of materials are stored in a single pile, the maximum gallonage permitted in that pile shall be the smallest of 2 or more separate maximum gallonages.

NOTE 2: Aisles shall be provided so that no container is more than 12 feet from an aisle. Main aisles shall be at least 8 feet wide and side aisles at least 4 feet wide.

NOTE 3: Each pile shall be separate from each other by at least 4 feet. (Numbers in parantheses indicate corresponding number of 55-gallon drums.)

8. Flammable liquids shall not be stored in the boiler room under any circumstances. (Wichita Fire Department)

9. Suitable fire control devices, such as a small hose or portable fire extinguisher, shall be available at locations where flammable or combustible liquids are stored. (OSHA)

10. At least one portable fire extinguisher having a rating of not less than 12-B units shall be located outside of, but not more than ten feet from the door opening into any room used for storage. (OSHA) (NIOSH)

11. In every inside storage room, there shall be maintained one clear aisle at least three feet wide. (OSHA)

12. In storage rooms, containers over 30 gallons shall not be stacked directly on top of each other. They must be stored in racks. (OSHA)

13. The storage of flammable and combustible liquids in a classroom area shall be in original sealed containers only, or in approved safety containers, not exceeding five gallons. If the liquid exceeds five gallons, storage shall be in an approved storage cabinet. (Wichita Fire Department)

14. Storage of flammable or combustible liquids in containers of over ten gallons shall be in approved storage cabinets, regardless of the location. (Wichita Fire Department)

STORAGE: OUT-OF-DOORS

1. If flammable and combustible liquids are stored outside, the area shall be graded so that spills are diverted away from any building.

OUTDOOR CONTAINER STORAGE (OSHA)

1	2	3	4	5
Class	Maximum per pile (see note 1)	Distance between piles (see note 2)	Distance to property line that can be built upon (see notes 3 and 4)	Distance to street, alley, public way (see note 4)
	gal	ft	ft	ft
IA	1,100	5	20	10
IB	2,200	5	20	10
IC	4,400	5	20	10
II	8,800	5	10	5
III	22,000	5	10	5

NOTE 1: When 2 or more classes of materials are stored in a single pile, the maximum gallonage in that pile shall be the smallest of the 2 or more separate gallonages.

NOTE 2: Within 200 feet of each container, there shall be a 12-foot wide access way to permit approach of fire control apparatus.

NOTE 3: The distances listed apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 shall be doubled.

NOTE 4: When total quantity stored does not exceed 50 percent of maximum per pile, the distance in columns 4 and 5 may be reduced 50 percent, but not less than 3 feet.

2. The storage area shall be kept free of combustible material not necessary for storage, such as weeds and other debris.

3. Smoking is not permitted in the area.

STORAGE: GASOLINE

1. Gasoline in less than 60-gallon quantities shall be stored in approved containers. (OSHA)

2. Quantities of gasoline in excess of 60 gallons shall be stored in tanks located underground or in specially designated enclosures.

3. Gas pumps shall have at least one fire extinguisher having a minimum approved classification of 6 B, C, located within 75 feet of the pump. (NIOSH)

4. "No Smoking" signs shall be posted.

STORAGE IN DRUMS

1. Pressure and vacuum relief vents shall be installed, with flash arrestors in the drum bung openings. These safety vents:

    A. prevent pressure explosions by automatically relieving drum punctures of excessive vapor pressures,

    B. provide for vacuum relief to facilitate withdrawal of liquids through drum faucets,

    C. cover the vent passages with perforated metal flash arrestors to prevent the propagation of outdoor sources of ignition into the drums.

2. After provisions for venting are made, the drums shall be stored with two drums end to end on metal racks and the end bung openings toward the aisle and the side bung openings (if any) on top.

3. Drums shall be bonded and grounded with an electrical conductor to drain off static electricity.

CONTAINERS

1. Portable tanks shall be equipped with internal pressure release valves. (OSHA)

2. Containers shall have approved self-closing faucets or be equipped with approved pumps taking suction through the top, unless stored in the original container. (OSHA)

3. Class I liquids shall not be delivered into a portable container unless the container is constructed of metal, has a tight closure with screwed or spring cover, and is fitted with a spout or so designed that the contents can be poured without spilling.

4. Dip tanks holding a flammable or combustible liquid shall be properly ventilated and have an automated extinguishing system suitable for a 150 gallon capacity tank. (OSHA)

5. Safety cans or other portable containers of flammable liquids having a flash point at or below 80 degrees F and table containers of flammable liquids (excluding shipping containers) shall be painted red with some additional, clearly visible identification either in the form of a yellow band around the can or the name of the contents conspicuously stenciled or painted on the can in yellow.

6. All safety containers shall be labeled as to contents. (Wichita Fire Department)

7. Containers must be metal unless the liquid:

    A. reacts with the metal and causes a chemical change,

    B. in the contained product is to be exported directly,

    C. in the contents is medicine, foodstuff, or a beverage.

TABLES H-12-MAXIMUM ALLOWABLE SIZE OF CONTAINERS AND PORTABLE TANKS(OSHA)

Container Type	Flammable Liquids	Combustible Liquids	
	Class 1A/Class 1B/ Class 1C	Class II/Class III	
Glass or approved plastic	1 pt./1 qt./1 gal.	1 gal.	1 gal.
Metal (other than DOT drums)	1 gal./5 gal./5 gal.	5 gal.	5 gal.
Safety cans	2 gal./5 gal./5 gal.	5 gal.	5 gal.
Metal drums (DOT Spec.)	60 gal./60 gal./60 gal.	60 gal.	60 gal.
Approved portable tanks	660 gal./660 gal./660 gal.	660 gal.	660 gal.

NOTE: Container exemptions: (a) Medicines, beverages, foodstuffs, cosmetics, and other common consumer items, when packaged according to commonly accepted practices, shall be exempt from 1910.-106 (d) (2) (i) and (ii) of the OSHA requirements.

SAFETY CANS

Approved safety cans (required by OSHA) are the most familiar safety equipment seen in many plants and probably among the least understood as to what they are and what they must do.

The basic purpose of a safety can is to control the flammable vapors, while providing a convenient means of carrying, dispensing, and storing up to five gallons of flammable liquid. This requires that the can must:

1. be leak tight.
2. automatically vent vapor at approximately five psig internal pressure to prevent rupture (or explosion in event of fire).
3. prevent flame from reaching the flammable liquid contents through the spout.
4. automatically close after filling or pouring.

In addition to these basic safety requirements, safety cans must be able to resist damage and wear in normal usage; permit ready, convenient use in pouring, filling, and carrying; and be properly marked to identify their contents. OSHA standards for portable safety containers to be used for flammable liquids having a flash point at or below 80 degrees F require a yellow band around the container or stenciling of identification of the can contents.

Several different types of safety cans, as well as a full range of can capacities, are needed for the most convenient, efficient service in the various use situations. These include Type I and Type II safety cans, terne-plate and nonmetallic can bodies, faucet and tilt-rack laboratory cans, and wide-mouth disposal cans.

To provide the necessary information for putting the right safety cans to their best uses, brief design and application data for each type follows:

CAP OPERATING MECHANISMS on safety cans are spring-loaded and self-closing to provide a leakproof spout seal and pressure relief venting. A can carrying handle is either attached to or integral with the cap operating mechanism. The design of the handle will greatly affect the convenience of carrying and using safety cans. The best design will swing to distribute the weight evenly and protect the cap when not in use. It will also enable the user to open the cap without any awkward secondary linkages.

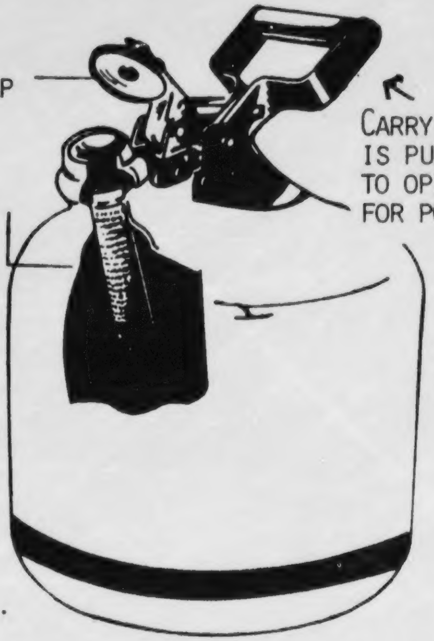
Spring pressure is applied to the self-aligning cap and its sealing gasket to make a leakproof seal with the rim of the can spout. The spring tension that seals the cap is also designed to allow the cap to lift in order to relieve excessive internal pressures.

For maximum life, cap sealing gaskets shall be of a material that is resistant to solvent action and continuous pressure. Experience indicates the synthetic compounds used in modern safety can seals are superior to the older, treated-leather gasiets.

FLAME ARRESTER SCREENS inside the cap spout are essential in the preventing of fire flashback to the can contents.

A flame arrester works because it provides such rapid dissipation of the heat from fire that the vapor temperature on the inside of the can remains below the ignition point. Pupils must be instructed not to remove or damage the screens. Any holes punched in the screens change the heat-absorption characteristics of the area involved and may nullify the effectiveness of the unit.

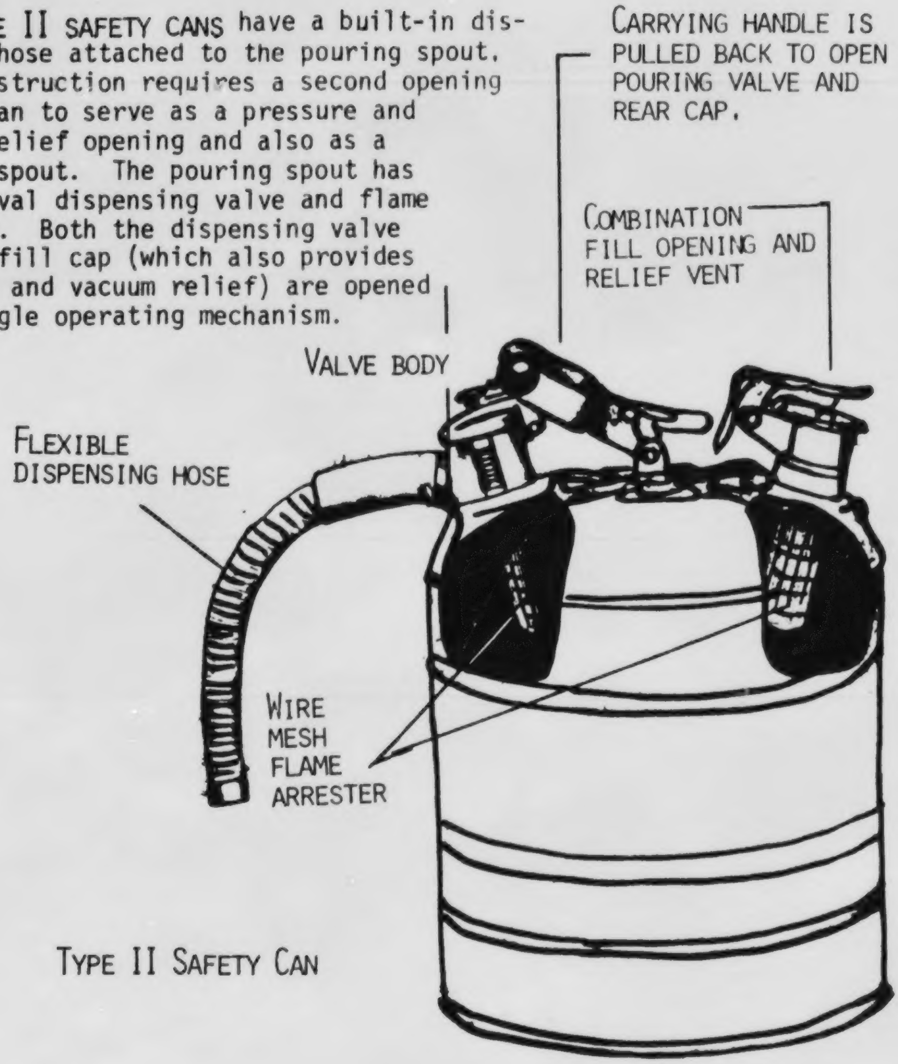
CAPACITY RATINGS - Safety cans must not be filled above their rated capacity, which is up to the seam that joins a metal can top to the body or to a fill level mark on a nonmetallic can. Overfilling can result in a dangerous liquid overflow from the spout if high external temperatures occur.


SPRING-LOADED PRESSURE RELIEF CAP
WIRE MESH FLAME ARRESTER
CARRYING HANDLE IS PULLED BACK TO OPEN CAP FOR POURING
TYPE I SAFETY CAN

TYPE I SAFETY CANS are the typical, single-spout safety cans in widest use for transfer, storage, and dispensing of flammable liquids in capactities from one pint to five gallons.

They are designed primarily for the filling of containers having large receiving openings, such as rinse or cleaning tanks. However, they can be equipped with accessory funnel-hose attachments for filling containers with smaller openings.

TYPE II SAFETY CANS have a built-in dispensing hose attached to the pouring spout. This construction requires a second opening in the can to serve as a pressure and vacuum relief opening and also as a filling spout. The pouring spout has an interval dispensing valve and flame arrester. Both the dispensing valve and the fill cap (which also provides pressure and vacuum relief) are opened by a single operating mechanism.


CARRYING HANDLE IS PULLED BACK TO OPEN POURING VALVE AND REAR CAP.
COMBINATION FILL OPENING AND RELIEF VENT
VALVE BODY
FLEXIBLE DISPENSING HOSE
WIRE MESH FLAME ARRESTER

TYPE II SAFETY CAN

METAL LABORATORY CANS are five gallon safety cans with faucets, designed for dispensing flammable liquids into smaller containers. Some models are available in both the shelf and tilt-rack types. The shelf dispensing can has a safety faucet near its base for gravity flow draining, and a top spout for filling and vacuum and pressure relief. The tiltrack laboratory can is mounted in a sturdy tilt frame, with the pouring spout on the can top opposite the fill and pressure-relief spout. Where test tubes, small flasks, and other small-opening containers are to be filled, these cans are recommended. Flexible metal safety hoses may be threaded into the faucets for complete control.

STORAGE CABINETS

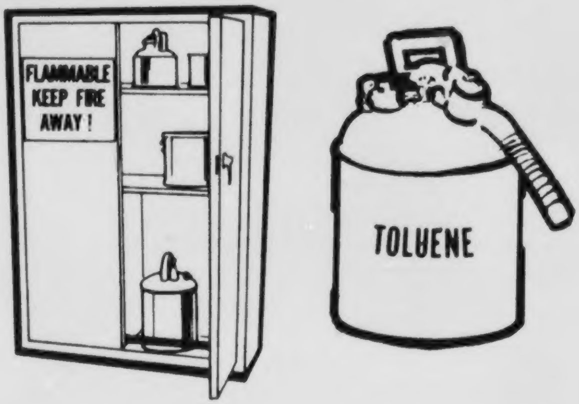
Storage cabinets shall be distinctly designated "Flammable - Keep Fire Away," and be able to withstand a ten minute fire test, with the internal temperature remaining at 325°F or less. Metal cabinets shall be constructed of at least No. 18 gauge sheet iron, double-walled with a 1 1/2 inch air space between. The doors must have three-point locks with the sills raised at least two inches above the cabinet floor. Wooden cabinets shall be constructed of one inch plywood with rabbeted joints fastened two-directionally with flathead screws. (NIOSH).

1. No more than 25 gallons of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet. (OSHA)

2. Quantities of flammable and combustible liquid in excess of 25 gallons shall be stored in approved cabinets. (OSHA)

3. Not more than 60 gallons of Class I or II liquids or 120 gallons of Class III liquids shall be stored in any one storage cabinet and no more than three storage cabinets shall be located in a single storage area. Excess quantities shall be stored in an inside storage room. (OSHA)

4. No combustible or flammable material shall be stored or used within three feet of gas-fired classroom equipment (i.e., kiln, forge, foundry, etc.). The area above the equipment shall also be clear to the ceiling. (NIOSH)

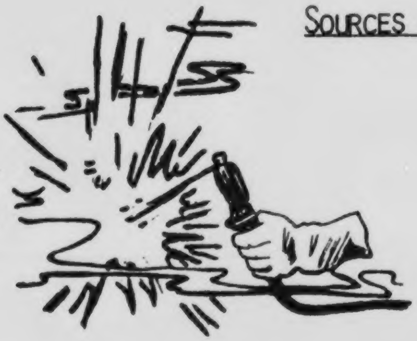


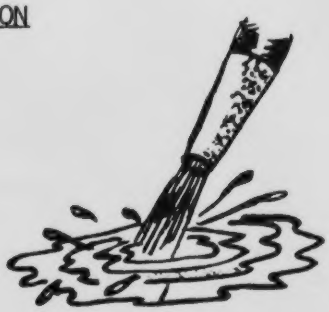
The quantity of flammable and combustible liquids allowed to be stored in inside storage rooms is dependent upon several factors: room size, fire resistance rating, and whether fire protection is provided. (NIOSH)

HANDLING

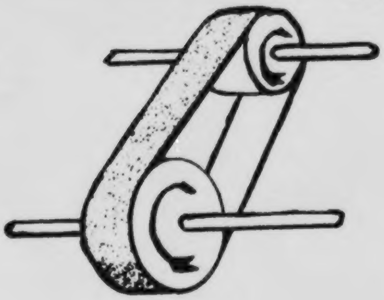
1. Flammable liquids shall be kept in covered containers when not in actual use. (OSHA)
2. Flammable liquids shall not be used near open flames or other sources of ignition. (OSHA)

SOURCES OF IGNITION

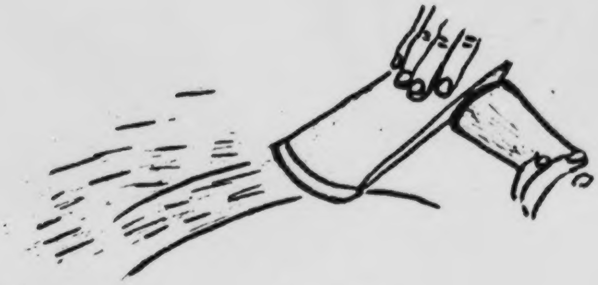




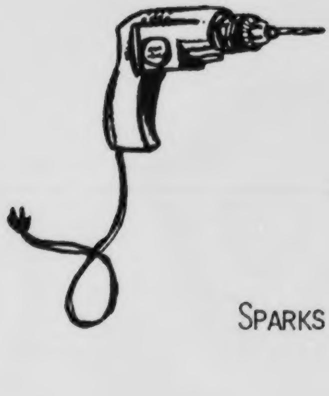
STATIC ELECTRICITY FROM TRANSFERRING LIQUIDS



STATIC ELECTRICITY FROM ROTATING BELTS



GRINDERS



SPARKS FROM ELECTRICAL TOOLS

3. The transfer of flammable and combustible liquids shall be by one of the following methods:

   A. a closed piping system

   B. a safety can

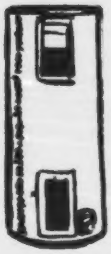
   C. a device (often an approved pump) to draw the liquid through the top of its container

   D. a container with a self-closing valve which permits the liquid to flow by gravity (never air pressure)

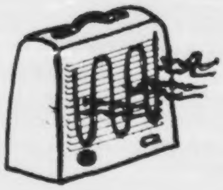
   NOTE: Both containers must be grounded or bonded to each other by the use of bonding cables while transferring liquids. (OSHA)

4. Where flammable or combustible liquids are used or handled, except in closed containers, means shall be provided to dispose promptly and safely of leakage and spills. (OSHA) If a major spill occurs, remove all ignition sources immediately and ventilate the area. These liquids must never be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion. (NIOSH)

SOURCES OF IGNITION

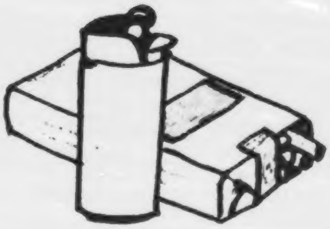


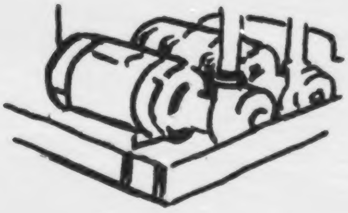
PILOT LIGHTS



HOT PLATES AND ELECTRIC COILS

SMOKING MATERIALS





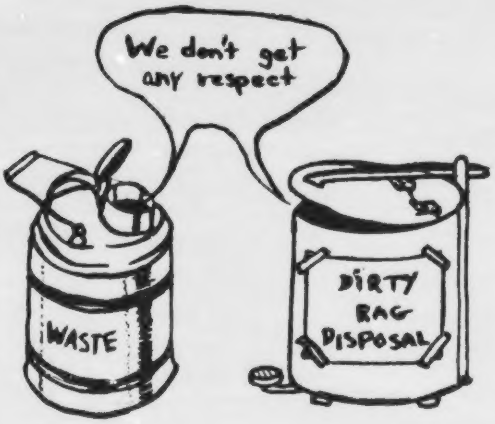
OVERHEATED BEARINGS

5. Class I liquids shall be used only where there are no open flames or other sources of ignition within the possible path of the vapor trail. (OSHA)

WASTE DISPOSAL

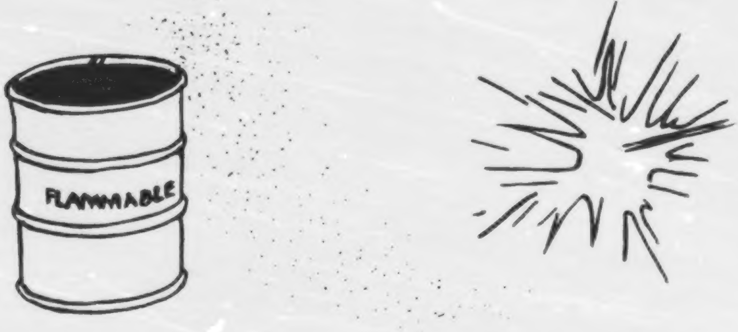
This subject deserves special mention. Used or dirty solvent, cleaning liquids, and rags or papers soaked with flammable or combustible liquid are often not treated with respect because they have served their purpose.

Waste materials can present extreme fire and health hazards. Waste materials shall be placed in fireproof, covered containers, which are emptied daily.



6. Waste products shall be deposited in closed containers and disposed of daily. (NIOSH)

Vapors of flammable and combustible liquids are heavier than air. In still air, they tend to settle and collect in lower areas, and the trail of vapors can spread far from the liquid itself. If this vapor trail contacts a source of ignition, the resulting fire can FLASHBACK to the source of the vapors.



Flashback and fire can occur even though the liquid and the ignition source are far apart.

7. Glass containers shall be limited to eight fluid ounces capacity when used for flammable or combustible liquids. (Wichita Fire Department)

8. Original metal containers may be utilized in the work area but shall be limited to one gallon in capacity. (Wichita Fire Department)

9. In using quantities greater than one gallon, safety containers shall be utilized. They shall not exceed two gallons, however. (Wichita Fire Department)

10. The total quantity being used within a class area shall not exceed five gallons, regardless of the container type. (Wichita Fire Dept.)

11. Flammable and combustible liquids shall be transported between work areas in open containers. Safety cans are to be used.

12. Proper ventilation shall be maintained when using flammable or combustible liquids.

Some of the more hazardous flammable liquids that may be encountered in shop activities are (listed in approximate order of hazard):

Starting Fluid

**Aerosol cans

Gasoline

*Catalysts M.E.K. Peroxide

Carburetor cleaner

Acetone

Lacquer and lacquer thinner

Adhering liquid
(for silk-screen process)

Paint thinner

Alcohol

Shellac

*Japan dryer

Kerosene

Paint

Resin (polyester)

Stain and varnish

Danish oil

* These materials could accelerate spontaneous combustion or could react violently when mixed with organic material.

**The hazard could vary greatly depending upon the propellant used in the can.

13. Work areas shall be kept free of debris, i.e. paper, sawdust, etc.

14. Gasoline shall not be used as a source of ignition.

15. Aerosol containers (either full or empty) shall be kept away from heat (including the sun). Aerosols are extremely dangerous.

16. A pupil shall draw out only as much liquid as is needed for a class period or particular operation.

17. A funnel shall be used when pouring flammable or combustible liquids into a small container.

18. The label must be read and the contents checked before using.

19. A person must follow instructions when adding catalysts to resins or finishes.

20. Catalyst must be added to resin, not resin to catalyst.

21. Flammable liquids will produce dense black smoke when burning, making the fire difficult to extinguish.

CLEANING

1. A designated area shall be established for such cleaning or washing. This area shall be well-ventilated and at least 20 feet from any flame or spark producing device. (NIOSH) (Wichita Fire Department)

2. Liquids with a flash point under 100°F (i.e., gasoline and lacquer thinner) shall not be used for cleaning or washing parts unless in an approved closed machine or in a specially-designated room or area. (NIOSH)

3. No Class I flammable liquid (having a flashpoint below 100°F) shall be used in, or in connection with, any garage or classroom for washing parts or removing grease unless in an approved closed machine or in a separate, well-ventilated room constructed in accordance with the provisions of the Building Code for an E-2 Occupancy. (Wichita Fire Department)

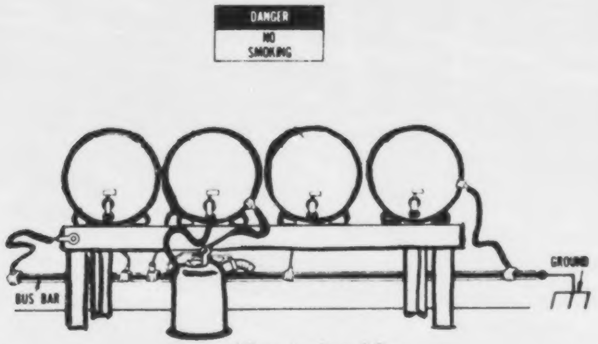
4. No Class I flammable liquid shall be used for cleaning floors or walls. (Wichita Fire Department)

5. Open containers may be used for cleaning; i.e., washing brushes, etc., but only temporarily. (Wichita Fire Department)

BONDING AND GROUNDING

Class I liquids (flash points below 100 degrees F) shall not be dispensed into containers unless the nozzle and container are electrically interconnected. If multiple storage containers are involved, then all containers must be bonded and grounded.

When flammable liquids are transferred from one container to another (for example, from one bulk container to another) they must be effectively bonded and grounded. This practice prevents electrical discharge (e.g., sparks) from the accumulation of static charge because of the transfer process.



Electrically
Interconnected

DRUMS GROUNDED AND BONDED TO RECEIVING CONTAINER

BONDING is done by making an electrical connection between the containers. The best way to do this is with a FLEXIBLE BONDING CONDUCTOR--a bonding strap or wire. Bonding can also be done by maintaining a solid metal to metal contact between the containers. This way is not as sure as using a bonding strap or wire.

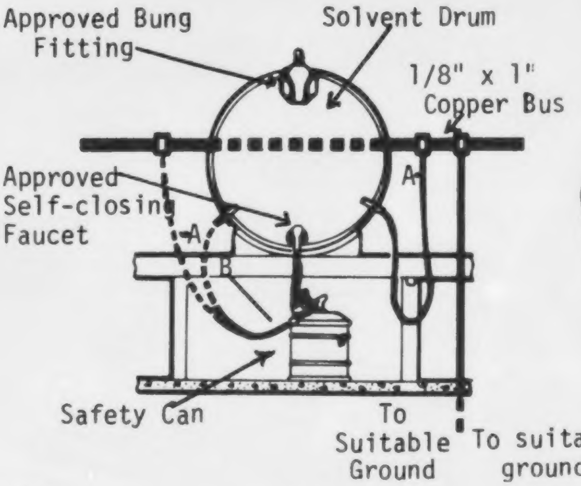
GROUNDING is done by providing a path for static charge to drain off to the earth. Grounding straps and wires must be connected to known grounds such as water pipes, grounded metal building framework, and metallic underground gas piping systems. All grounding equipment must be periodically tested to make sure it is still effective.

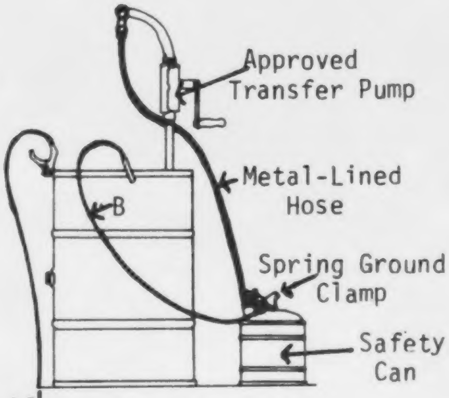
Hazardous static electricity sparks are produced by the transfer of liquids from one container to another and are a particularly common problem in dispensing flammable liquids from drums. The hazards of these static sparks can be prevented by utilizing proper grounding and bonding methods.

In the diagrams below, approved grounding techniques are illustrated for both the faucet-type and pump-type dispensing operations. It is important to note:

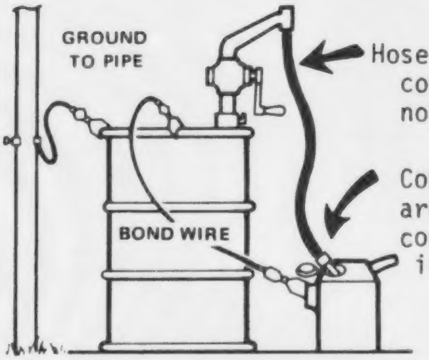
1. When dispensing by faucet, the faucet spout should be brought into direct contact with the fill opening of the receiving container; lengths of special flexible metal hose should be used to connect the faucet spout with the fill opening of the receiving container in order to form a suitable bond.

2. When dispensing by pump, the pump should be equipped with a dispensing hose to form a suitable bond between the pump nozzle and the receiving container.


Approved Bung Fitting
Solvent Drum
1/8" x 1" Copper Bus
Approved Self-closing Faucet
A
A
B
Safety Can
To Suitable Ground
To suitable ground

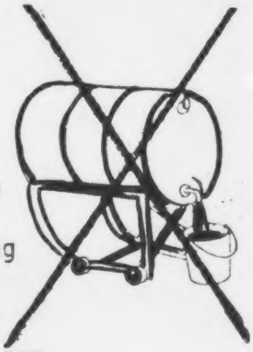

Approved Transfer Pump
Metal-Lined Hose
B
Spring Ground Clamp
Safety Can

SOLVENT DRUM


GROUND TO PIPE
BOND WIRE

Hose may be either conducting or non-conducting.

Conducting hose and nozzle are in contact with the container--no other bonding is necessary.



GROUNDING-WIRE ASSEMBLIES
A - Hand Clamp X lug B = Hand Clamp X Hand Clamp

PAINTS

Paint ingredients include pigments, binders, solvents, drying agents, etc. Solvent-based paints and thinners exert a narcotic effect when the solvent, which becomes airborne during spraying and drying operations, is breathed in excessive concentrations. Long-term exposures can cause liver and lung damage. Some of the ingredients used in paints are toxic. Of the many paint pigments in common use, lead, chromium, and cadmium compounds are particularly toxic. For these reasons, as well as for fire protection, adequate ventilation is required in paint spray areas and in spray booths.

Although the use of water-soluble paints can solve the problems of inhaling the organic solvent vehicle and paint flammability, it should be noted that it does not reduce the respiratory problems posed by toxic pigments, driers, or other ingredients which become airborne during spraying or oven curing. (NIOSH)

1. Oil-based paints should be treated like any other combustible liquid.

2. Some of the newer paints contain hardeners and other additives that can cause skin rashes and dermatitis.

AEROSOLS

A much used and convenient form of spray painting, especially for small jobs, is that of using aerosol paint cans. However, these cans represent a very dangerous hazard and must be treated with the upmost respect.

1. Aerosol cans are internally pressurized and must never be heated or punctured. They should always be stored at room temperatures or below and in approved storage areas or cabinets.

2. Aerosols must never be used near open flames or sources of heat. They must be treated as any other flammable liquid.

3. The spray of an aerosol must never be directed toward another person.

4. Aerosol cans must never be used for games of "toss and catch."

5. Empty aerosol cans are never completely empty; a portion of the pressurizing agent remains. Consequently, the disposal of the can should be handled with extreme caution and it must never be incinerated.

6. As in any spray painting operation, adequate ventilation must be in effect.

PERSONAL PROTECTION

1. Fire isn't the only danger associated with these liquids. Many of them can be very hazardous to one's health.

2. There are thousands of liquids in use which are health hazards. No matter which liquids are used or the manner in which one uses them the following basic rules are worth remembering:

   A. AVOID SKIN CONTACT. Most flammable and combustible liquids will remove the oils from the skin and cause irritation, cracking, rashes, or infection. Protective gloves and aprons must be worn if there is a chance of skin contact. Liquids must be washed from the skin with non-abrasive soap or hand cleaner.

   B. DON'T BREATHE THE VAPORS. Avoid breathing the vapors of any liquid. Use these liquids only in a well-ventilated area. If ventilation is not possible, use an approved respirator. Be especially cautious when working in confined space.

   C. PROTECT THE EYES. Always wear safety glasses or goggles when pouring flammable or combustible liquids. If one sprays these liquids, or if there is a chance of the liquids splashing in the face, a full face shield should be used.

   D. If someone is splashed with a harmful or a burning liquid, he/she may not be able to help himself/herself. Chemical splashes and burns can be very painful, and each worker must depend on his/her coworkers for help in an emergency. If someone is splashed, get him/her to running water immediately. Flush the splashed area with water for at least 15 minutes, and remove contaminated clothing while flushing with water. Get medical attention immediately.

   E. If someone is burned or splashed with burning liquid, put out the fire with water (not a chemical extinguisher) or by smothering the flames, and get medical attention immediately.

SOLVENTS

Solvents are used to suspend pigments, dissolve film-forming oil materials, and as thinners to dilute paints and reduce paint viscosity.

Organic solvents have some effect on the central nervous system and the skin. The principal mode of exposure is inhalation, which may cause impairments (i.e., lack of coordination or drowsiness) that have no discernible permanent effects on health but may increase the risk of accidents. In other cases, exposure may result in serious damage to the blood, lungs, liver, kidney, and gastrointestinal tract.

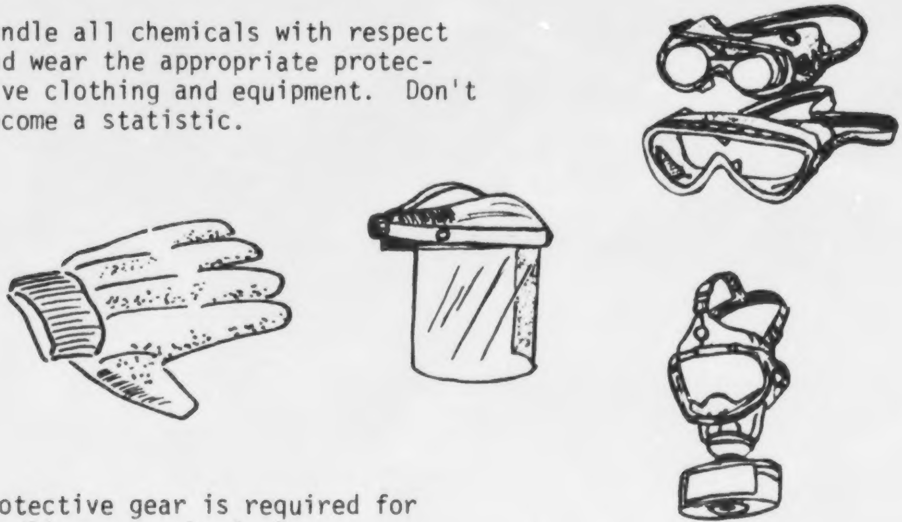
Skin contact with solvents may cause dermatitis, ranging in severity from a simple irritation to actual damage to the skin. Even the most inert solvents can dissolve the natural protective barriers of fats and oils, leaving the skin unprotected. When these natural lubricants are removed, the skin becomes subject to disabling and possibly disfiguring dermatitis and opens the way to serious infection. (NIOSH)

RULES FOR THE USE OF SOLVENTS

1. Less toxic solvents shall be substituted, when suitable.
2. A mechanical exhaust system or respirators shall be utilized, where necessary.
3. Protective clothing shall be worn at all times. A face shield or chemical goggles must be used for minimum protection.
4. Solvents must be kept covered when not in use or in between actual applications.
5. Gasoline shall not be used for cleaning.
6. Rags, or other materials used for cleaning, that have been soaked with solvent must be disposed of properly and immediately in approved safety containers.
7. A chemical is never to be tasted in order to decide what it is.
8. Siphons on a solvent container are never to be started by sucking on the hose. One swallow of solvent may be deadly. A splash in the face can be serious.

9. Good personal hygiene is essential whenever solvents are used. The skin must be protected from contact with solvents. Gloves, face shields, goggles, and other protective clothing must be used. Creams offer some degree of protection. The skin must not be washed with any raw organic solvent. It removes fats from the skin and may be absorbed through the skin.

Handle all chemicals with respect and wear the appropriate protective clothing and equipment. Don't become a statistic.



Protective gear is required for handling many chemicals.

10. A person who has used a solvent should wash with a waterless hand cleaner, although a mild soap and tepid water is effective.

11. Food or beverage containers are never to be used to store or dispense solvents. Even when labeled, the solvent could be mistakenly swallowed. Solvents are to be properly stored in labeled, approved safety containers.

12. CAUTION: Don't try to get a victim of solvent ingestion to vomit. The solvent may wind up being breathed into the lungs.

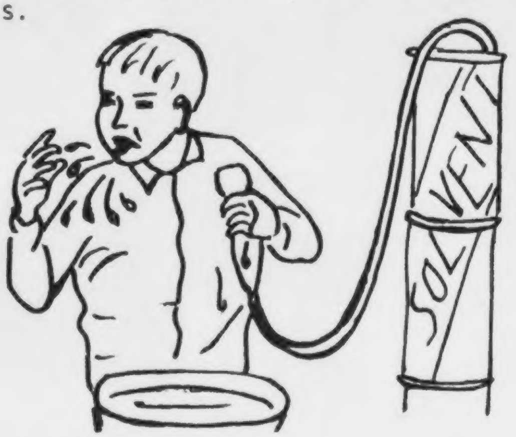
13. CAUTION: So-called "exempt solvents" and "safety solvents" can have both health and fire hazards. All that "exempt means is that the solvent vapors do not form smog readily when exposed to sunlight. Safety solvents are ones that don't damage a particular material, or ones which pose less of a fire hazard. Safety solvents are usually mixtures containing chlorinated, as well as non-chlorinated, organic solvents.

14. Chlorinated organic solvents belong to the category of solvents that includes such known hazardous chemicals as carbon tetrachloride and trichloroethylene. While chlorinated organic solvents are

usually not fire hazards, their vapors can produce several toxic gases (including phosgene), if welding is done in their presence. This is due to the presence of invisible ultra-violet light caused by the welding arc. This light is also produced by arc lamps, anti-setoff bulbs, and UV-ink curing units.

15. Unlike those organic solvents that aren't chlorinated, the chlorinated solvents tend to build up in the body over a period of time and can do damage in the process.

SWALLOWING ORGANIC SOLVENTS CAN KILL.



A. If a person swallows some solvent, get medical (school nurse) help immediately.

ORGANIC SOLVENTS ALSO HARM THE SKIN.

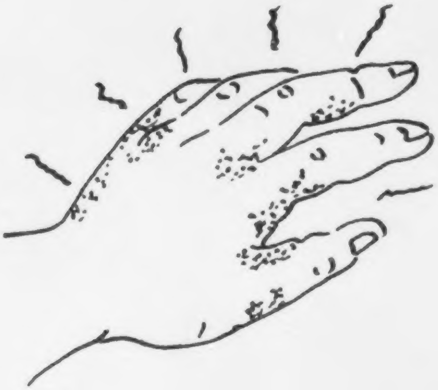
B. As a result of repeated skin exposure to solvents, the skin dries, flakes, and cracks - easily leading to dermatitis.

C. Germs can enter this unhealthy skin and cause infections that are hard to cure.

D. Some solvents cause burns.

E. A few solvents (like turpentine) can cause allergic reactions to the solvent. This is called sensitization.

F. Some solvents can actually pass through perfectly healthy skin and enter the bloodstream. They pass through unhealthy skin (skin that is cut, punctured, scraped, or peeling) even faster.



THE OBVIOUS SOLUTION IS TO KEEP SOLVENTS FROM REACHING THE SKIN.

G. Wear a long-sleeved shirt--where work allows--with close-fitting sleeves.

H. Wear impervious gauntlet gloves when solvents are handled. Neoprene gloves are impervious to most litho chemicals (printing industry), including solvents.

I. ("Impervious" means the solvent can't get through the rubber or other material to reach the skin.)

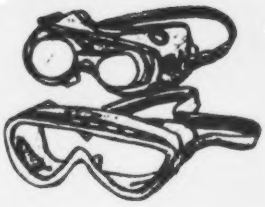
J. Get clean gloves if the insides of the ones being worn become contaminated with solvent.

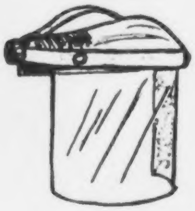
K. Do not touch the face or eyes when wearing gloves.

L. To avoid abrading the skin, wash with a waterless hand cleaner rather than a gritty one.

M. Apply a hand lotion after washing.

SUGGESTED EYE PROTECTIVE EQUIPMENT

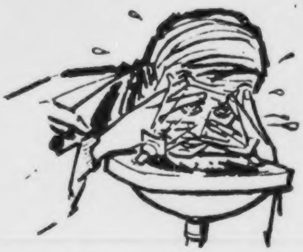




Paint and solvent splashes can harm the eyes. Keep them out of the eyes by wearing splash-proof safety goggles. Pupils should know the location of the emergency eye wash fountain or other source of running water for flushing the eyes in case of chemical splashes. When handling solvents, it's also a good idea to wear a face shield for protection from splashes.

FIRST AID

EYE CONTACT--Flush the eyes immediately at the nearest eyewash fountain, sink, or other source of clean water. Spread the lids open with the fingers and roll the eyes around in their sockets. Continue for 15 minutes. After flushing the eyes, get first aid from a trained person (school nurse). Don't use home remedies, such as boric acid.



EYEWASH STATION

CAUSTIC CLEANERS

Caustics, such as sodium hydroxide and potassium hydroxide, are often used to clean metal parts. Caustic chemicals are all strong irritants. Eye injury is the most severe result of contact with caustic chemicals. Damage to the skin, mucous membranes, and respiratory tract can also result from exposure to caustics. Strict procedures for handling caustics must be followed. Adequate safeguards, such as emergency showers and eyewashes, must be provided. Caustic mists shall be controlled at the source of dispersion by effective methods, such as full enclosure or local exhaust ventilation.

CHROMIC ACID

If chromic acid is used (such as in automatic cleaning systems for metal parts), pupils and teachers who work with or near it should be trained to recognize the hazards of the acid and to take the necessary protective measures.

Chromic acid can cause skin dermatitis and a condition known as "chrome holes" (skin ulcers; most commonly found on the hands-at the base of the nails and over the knuckles). Additionally, airborne chromic acid (mist form) causes inflammation of the eyes and chest pains. Chromic acid also attacks the nasal membranes. Early signs of damage from inhaled chromic acid mist are nasal dryness, nosebleed, and scabbing. Exposure for months or years can result in perforation of the nasal septum (divider).

Chromic acid mist must be controlled at the source of dispersion by methods such as full enclosure, local exhaust ventilation, or the use of surface active agents that reduce mist formation (or by a combination of these methods). EMERGENCY SHOWER, HANDWASH, AND EYEWASH FACILITIES MUST BE PROVIDED IN AREAS WHERE CHROMIC ACID IS USED.

Home Chemicals: Aerosols

It is estimated that each year 5,000 people receive emergency room treatment for injuries associated with aerosols. There were over two billion aerosol cans manufactured in the United States last year.

ACCIDENT PATTERNS ASSOCIATED WITH AEROSOLS

1. Explosions caused by high temperatures.
2. Explosions caused by puncturing.
3. Flammability of contents or propellents.
4. Toxicity of contents or propellents.
5. Chemical burns.

Follow These Suggestions For:

USING

1. Read instructions and warning statements carefully before using.
2. Spray only in well ventilated areas.
3. Don't smoke while spraying.
4. Don't use sprays near heating appliances, gas stoves, or other flame or heat sources.
5. Keep body well covered and wash exposed areas after spraying.
6. Stop use at first sign of dizziness, nausea, headache, blurred vision or skin irritation. Seek fresh air immediately.
7. Don't use around food items.

STORING

1. Keep container in a cool place.
2. Don't expose to direct sunlight, radiators, stoves, or other sources of heat.
3. Don't store in car where temperatures can get very hot on warm days.
4. Keep out of reach of children.

Home Chemicals; Aerosols continued

DISPOSING

1. With other non-burnable trash.
2. Don't puncture container.
3. Don't put in incinerators or trash compactors.

RADIOACTIVITY

1. Any experiments or projects in atomic energy and radioactivity, and the disposal of radioactive waste materials, must conform to the safety practices recommended by the Atomic Energy Commission.

2. The possession and use of any radioactive materials must comply with the laws of the state and federal governments.

3. The teacher should be aware of the responsibilities and liabilities involved in the use of radioactive materials.

4. All radioactive materials must be properly stored and locked in specially labeled cabinets. Only what is necessary should be available, and that in small amounts only.

5. Any pupil use of radioactive materials must be carefully planned, pretested, and supervised by the teacher.

6. Protective equipment such as lead sheets, bricks, cement blocks, and monitoring equipment should be available. Maximum personal protection includes the use of special lead-filled gloves and aprons for pupil and teacher use.

7. All radioactive materials should be labeled with indications of radioactivity levels, date of assay, kind, and quantity.

8. Absolutely no food or beverages should be allowed in any area where radioactive materials are being used or stored.

9. Radioactive materials must not come in contact with the skin or with open sores. Radioactive materials must not be handled with the bare hands.

10. Hands should be washed and monitored after each use.

11. Good housekeeping rules must be followed when using radioactive materials. The accumulation of radioactive waste should be avoided.

12. The disposal and decontamination of all radioactive materials, and other items used while working with these materials, must follow the guidelines and procedures established by the U.S. Energy Research and Development Administration, Office of Public Affairs, Washington, D.C. 20545.

RADIOACTIVE MATERIALS

1. All radioisotopes should be labeled "Radioactive," including indications of the level of radioactivity, the date of assay, the kind, and the quantity of radiation.

2. The storage of radioactive materials should be in a locked cabinet that is clearly marked "Radioactive Material."

3. It is important that the eating, drinking, or applying of cosmetics not be permitted in areas where radioactive materials are located.

4. One should avoid getting radioisotopes near the eyes, mouth, or open sores.

5. A researcher shall not use a pipette to transfer radioactive materials.

6. All radioactive specimens brought into the laboratory must be checked to be certain the radiation is not at a dangerous level.

7. The Energy Research and Development Administration (ERDA), Office of Public Affairs, Washington, D.C. 20545 should be consulted for the use or disposal of radioisotopes that have levels of radiation above the microcuric range.

   Other references include:

   "Radiation Protection in Educational Institutions"
   Reports No. 32 and 35
   National Council on Radiation Protection and Measurement
   P.O. Box 4867
   Washington, D.C. 20008

   How to Handle Radioisotopes Safely, 1971
   National Science Teachers Association
   1742 Connecticut Avenue, N.W.
   Washington, D.C. 20009

8. Teachers should be aware of the fact that the federal government has set certain limits on the possession and use of radioactive materials. The limits involve the total amount of radioactive material a school may have, plus the accountability and use of such materials.

EXPLOSION PROOF REFRIGERATORS AND FREEZERS

Explosion proof means that no damaging explosion can result from sparking or arcing in the electrical wiring, relay, thermostat, or compressor located inside or outside the cabinet. Volatile, low vapor pressure materials are potentially explosive and must be protected against sources of ignition. Underwriters' Laboratories, Inc. specifies rigid requirements, as does OSHA and the National Fire Protection Association, for storage of hazardous materials. Every motor, switch, and thermostat must be designed to prevent an arcing or sparking that can trigger a destructive explosion.

1. An explosion proof interior eliminates explosions caused by explosive fumes seeping from containers within the working chamber.

2. An explosion proof exterior eliminates explosions due to explosive fumes leaking from the interior of the cabinet to the exterior and coming in contact with electrical components.

3. An explosion proof exterior eliminates explosions due to explosive fumes in the surrounding area.

A conventional refrigerator and/or freezer is totally unsuitable for the storage of hazardous materials. The conventional domestic or commercial unit has numerous inherent danger points in its electrical system which can cause an explosion harmful to both life and property. Numerous fires and costly explosions have been caused by improper storage.

Examples of hazardous materials that may be stored in explosion proof regrigerators include: ethyl ether vapor, ethylene, cyclopropane, gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer, solvent vapor, natural gas, etc.

LIST OF MANUFACTURERS OF EQUIPMENT FOR FLAMMABLE AND COMBUSTIBLE LIQUIDS

1. Eagle Manufacturing Company, Wellsburg, WV., 26070 (manufacturers of safety cans, storage cabinets, drums, lab cans, and waste cans).

2. Justrite Manufacturing Company, 2061 North Southport, Chicago, IL., (manufacturers of flammable and combustible liquid containers).

3. Lab Safety Supply Co., P.O. Box 1368, Janesville, WI., 53545 (manufacturers of explosion-proof refrigerators and freezers, safety containers, storage cabinets, respirators, science laboratory equipment, fire extinguishers, and personal protective equipment).

4. The Protectoseal Company, 225 Foster Ave., Bensenville, IL., 60106 (manufacturers of storage cabinets, fire extinguishers, safety containers, porduction equipment, and various personal protective equipment.

SPRAY FINISHING OPERATIONS

One of the greatest hazards in the public school is the area where spray finishing operations are conducted. Spray rooms or spray booths are usually located in the art and industrial education laboratories. The primary danger is that most of these installations do not meet current safety standards and present a fire hazard to facilities and equipment as well as a threat to personal safety.

This unit is dedicated to identifying the regulations and codes of the OCCUPATIONAL SAFETY AND HEALTH ACT and the NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH standards in an effort to provide the teacher and administrator with proper guidelines to be used in evaluating their facilities. Finishing operations are many and varied; therefore, the information contained may not be all inclusive. In all cases, consult the local representatives of the Fire Department, OSHA office, National Fire Protection Association, or the Department of Human Resources.

DEFINITIONS

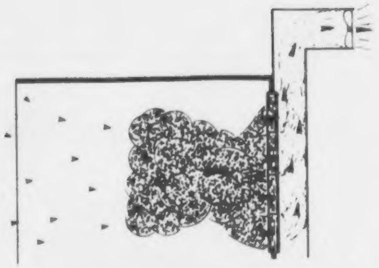
SPRAY FINISHING OPERATION: Employing methods whereby organic or inorganic materials are utilized in a displaced form for deposit on surfaces to be coated, treated, or cleaned. Such methods of deposit may involve either automatic, mechanical, or electrostatic deposition.

SPRAY ROOM: A room in which spray-finishing operations not conducted in a spray booth are performed separately from other areas.

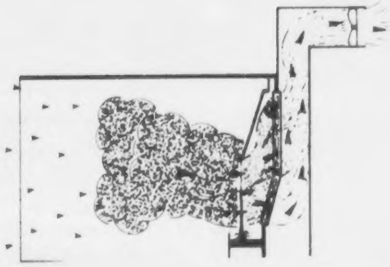
NOTE: If paint spraying operations are conducted in a spray room without the benefit of a spray booth, the room shall comply with the same requirements as a paint booth. The walls and doors of that room shall be of one hour rated fire resistance.

In the public schools, any room containing an approved spray booth must be constructed using one hour minimum-rated fire resistant walls and doors.

SPRAY BOOTH: A power-ventilated structure used to enclose or accommodate a spraying operation. The booth confines and limits the escape of spray, vapor, and residue, and safely conducts or directs them to an exhaust system.



FILTER BANK EXHAUST SYSTEM



WATERFALL EXHAUST SYSTEM

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SPRAY FINISHING OPERATIONS

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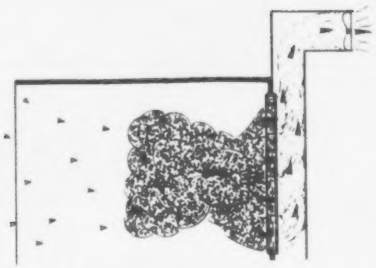

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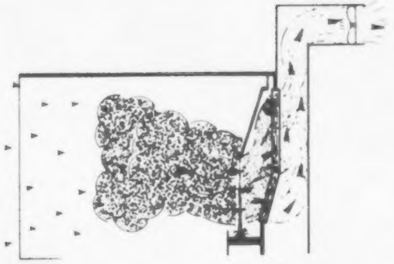
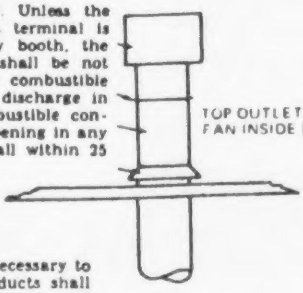


WATERFALL EXHAUST SYSTEM

SPRAY BOOTH

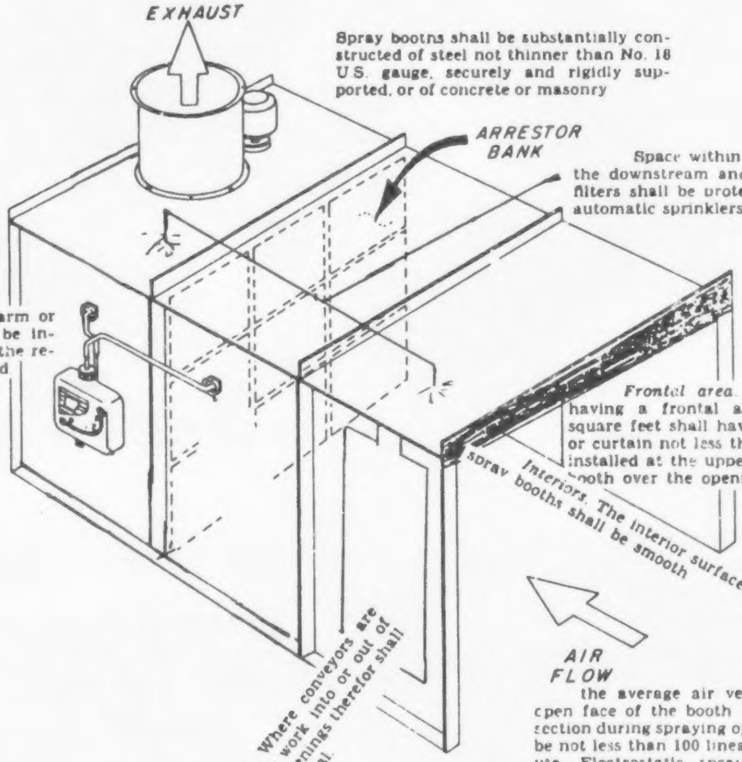
Major Mandatory Requirements

Discharge clearance. Unless the spray booth exhaust duct terminal is from a water-wash spray booth, the terminal discharge point shall be not less than 6 feet from any combustible exterior wall or roof nor discharge in the direction of any combustible construction or unprotected opening in any noncombustible exterior wall within 25 feet.



(10) *Access doors.* When necessary to facilitate cleaning, exhaust ducts shall be provided with an ample number of access doors.

Minimum separation. There shall be no open flame or spark producing equipment in any spraying area nor within 20 feet thereof, unless separated by a partition.



Spray booths shall be substantially constructed of steel not thinner than No. 18 U.S. gauge, securely and rigidly supported, or of concrete or masonry.

Space within the spray booth on the downstream and upstream sides of filters shall be protected with approved automatic sprinklers.

Visible gauges or audible alarm or pressure activated devices shall be installed to indicate or insure that the required air velocity is maintained.

Frontal area. Each spray booth having a frontal area larger than 9 square feet shall have a metal deflector or curtain not less than 2½ inches deep installed at the upper outer edge of the booth over the opening.

Interiors. The interior surfaces of spray booths shall be smooth

the average air velocity over the open face of the booth (or booth cross section during spraying operations) shall be not less than 100 linear feet per minute. Electrostatic spraying operations may be conducted with an air velocity over the open face of the booth of not less than 60 linear feet per minute.

(7) *Conveyors.* Where conveyors are arranged to carry work into or out of spray booths, the openings therefor shall be as small as practical.

ARRESTOR BANK All discarded filter pads and filter rolls shall be immediately removed to a safe, well-detached location or placed in a water-filled metal container and disposed of at the close of the day's operation unless maintained completely in water.

(Binks Manufacturing Company)

SPECIFICATIONS

Spray booths or spray rooms are to be used to enclose or confine all spray operations.

The booth shall be constructed of 18-gauge steel or other approved non-combustible material, and inside surfaces shall be smooth (to aid in cleaning). The booth shall be designed to sweep air currents toward the exhaust outlet.

The floor surface and operator's area shall be covered with a non-combustible material of such character as to accommodate safe cleaning and removal of residues.

Each spray booth having a frontal area larger than nine (9) square feet shall have a metal deflector or curtain not less than two and one-half (2 1/2) inches deep. It shall be installed at the upper edge of the booth over the opening.

The spray booth and duct shall be electrically bonded and connected to ground.

Any glass within three feet of the booth will be wired glass.

Electrical wiring, switches, light fixtures, etc. that are attached to any spray booth shall be explosion proof and otherwise in accordance with Class I, Group D, Division I - Hazardous Locations.

NOTE: If spray finishing operations are conducted in a spray room without the benefit of a spray booth, then the application applies to a spray room.

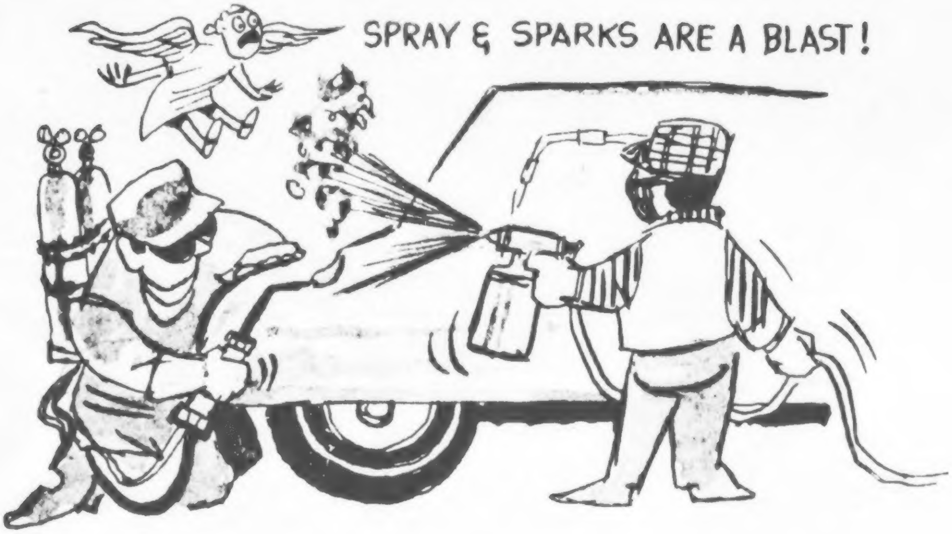
Electrical wiring, motors, and other electrical equipment inside a room containing a spray booth and located outside of, but within twenty (20) feet of the spray booth, shall conform to Class I, Division II - Hazardous Locations.

A three-foot clearance between the booth and combustible materials or construction is required.

Space heating appliances, steam pipes, or hot surfaces shall not be located in a spraying area where deposits of combustible residues may readily accumulate.

Electric lamps outside of, but within twenty (20) feet of any spray area and not separated from the spray area by a partition, shall be totally enclosed to prevent the falling of hot particles and shall be protected from mechanical injury by suitable guards or by their location.

No open flame or spark-producing device is allowed within twenty (20) feet of any spray area.


SPRAY & SPARKS ARE A BLAST!

Sprinkler systems, supplied by a domestic water supply, shall be installed both in the space on the downstream and upstream side of the filters. No cut-off valves are allowed between the source origin and the sprinkler heads (dry-type booths). There is a limit of three sprinkler heads to each system supplied by domestic water supply.

NOTE: Sprinkler heads must be kept clean from spray residue in order to function properly. The sprinkler heads may be covered with small paper sacks, DO NOT COVER THEM WITH PLASTIC.

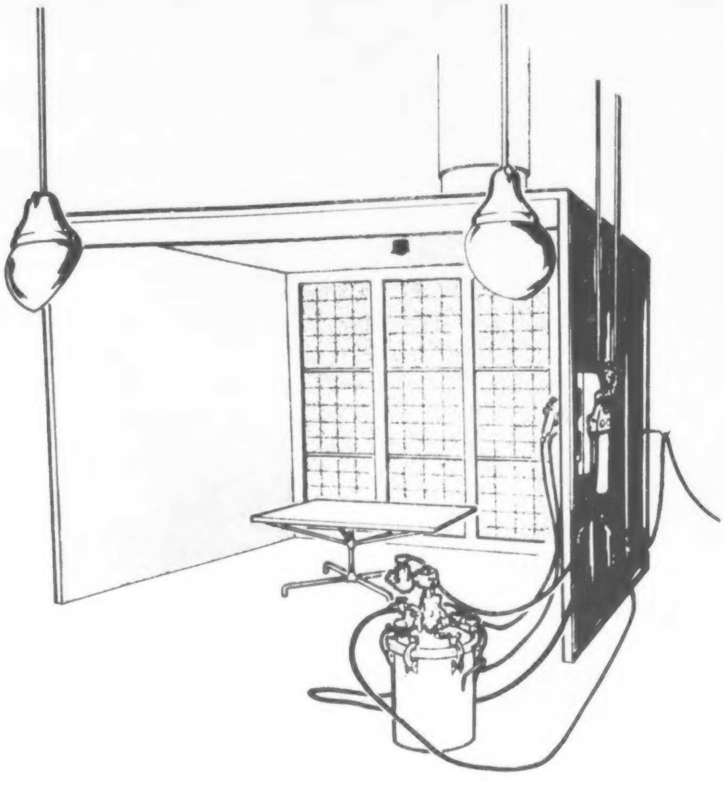
An adequate supply of suitable, portable fire extinguishers shall be installed near all spraying areas.

DRYING SPACES: Freshly sprayed articles shall be dried only in spaces provided with adequate ventilation to prevent the formation of explosive vapors.

CLOTHING STORAGE: Clothing worn during spray finishing operations shall not be left on the premises overnight unless the clothing is kept in metal lockers.

HAZARDOUS MATERIALS COMBINATION: Spray booths shall not be alternately used for different types of coating materials, when the combined materials may be conducive to spontaneous ignition, unless all deposits of the first used material are removed from the booth and exhaust ducts prior to spraying with the second used material.

VENTILATION



Adequate ventilation controls health, fire, and explosive hazards when the operator is spraying. The mists and vapors are collected from the spraying area by a local exhaust system. The spray must not be exhausted through the operator's zone. Spray booths or rooms equipped with exhaust ventilation are required for all spray-painting operations (except for the occasional touch-up or the infrequent painting of small objects). Booths or rooms are required for all production spray finishing.

All spraying areas will be provided with mechanical ventilation, that is adequate to remove flammable vapors, mists, or powders to a safe location. The ventilation system shall operate at all times while spraying for a sufficient time afterwards so that vapors from drying materials can be evacuated.

Audible alarms, pressure-activated devices, or visible gauges shall be installed to indicate or assure that the required air velocity of one hundred (100) linear feet per minute is maintained across the face of the booth.

The spray material from the booth shall be exhausted to the outside and will not be discharged to contaminate makeup air being introduced.

When ambient temperatures are below 55 degrees F. the makeup air must be maintained at 65 degrees F. The heater for the makeup air must be located outside the spray booth.

As an alternative to an air replacement system complying with the preceding section, general heating of the building . . . may be employed if all occupied parts of the building are maintained at not less than 65 degrees F. when the exhaust system is in operation.

An exhaust motor cannot be installed within the booth or duct itself. The motor shall be one which will not produce sparks under normal operating conditions and shall conform to provisions for Class I, Group D, Division I - Hazardous Conditions. Belts and pulleys of all fans and motors shall be fully enclosed.

Each spray booth shall have an independent exhaust; the terminal point shall be not less than six (6) feet fromany combustible wall or roof. Access doors shall be provided in the duct for ease of cleaning.

An exhaust duct shall be constructed of steel and shall be substantially supported to sustain its weight plus any normal accumulation in the interior during normal operating conditions and any negative pressure exerted upon it. At least eighteen (18) inches clearance must be provided between the exhaust duct and any combustible material.

Consult OSHA 1910.94 and 1910.107 for standards concerning fan capacity, length of duct, diameter of duct, volume, and character of materials.

The electrical equipment shall be so interlocked with the ventilation of the spraying area that the equipment cannot be operated unless the ventilation fans are in operation. At the completion of the work, the fan will continue to operate for a minimum of three (3) minutes after the fan switch is turned off. A time-delayed switch will allow the purge of spray vapors.

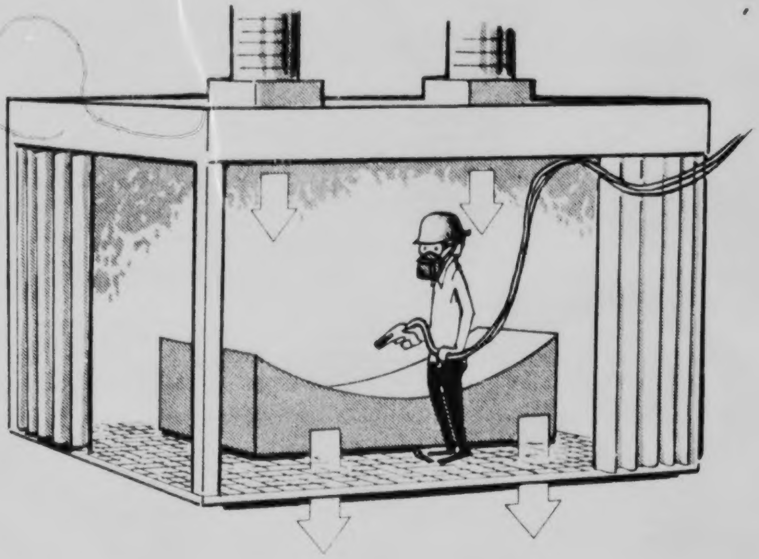
GENERAL SAFETY INSTRUCTIONS FOR THE SPRAY AREA

1. The quantity of flammable or combustible liquids in the vicinity of the spray operations shall not exceed the supply required for one day.

2. Portable, electric lamps shall not be used in any spraying area during spraying operations.

3. "NO SMOKING" signs are to be posted.

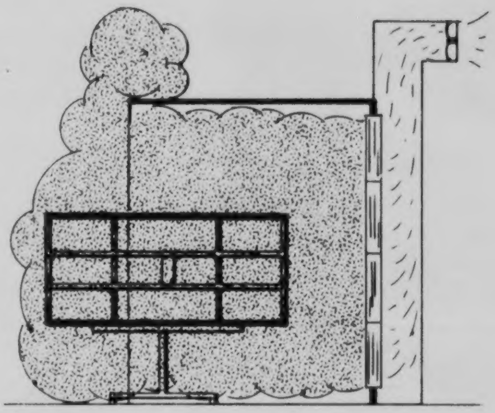
4. Parts to be painted will be arranged so that aerosprays and fumes are not drawn through the breathing area.



Good system--downdraft booth for sprayup.

SPRAY BOOTHS are recommended for fiberglass sprayup, gun wetting, and rollout operations. The spray booth exhaust system operates to draw vapors from the operator's breathing zone.

5. Contamination of the work area and pupil by high vapor concentration is caused by painting too large a piece in a shallow, open-faced booth. The object to be painted must be entirely enclosed by the booth.



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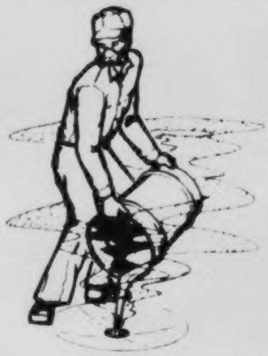
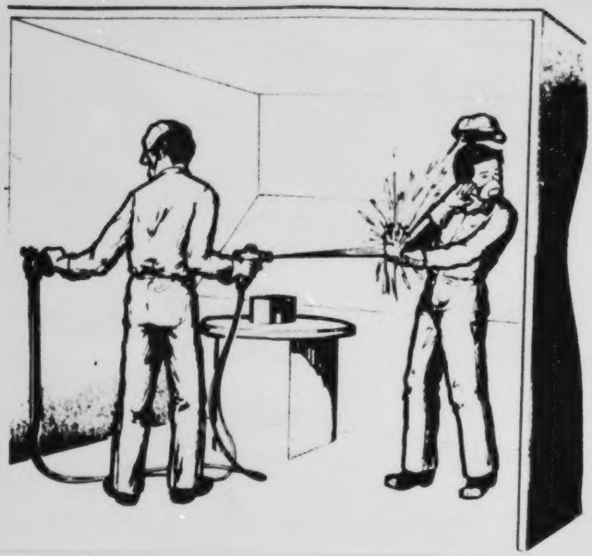
6. Low-flash point thinners (less than 100 degrees F.) may be used for cleaning purposes, but only in a well-ventilated area such as a spray booth.

7. Filter pads shall be inspected after each period of use, and clogged filter pads discarded and replaced. All discarded filter pads shall be immediately removed to a safe, well-detached location or placed in a water-filled metal container and disposed of at the end of the day.

8. Waste disposal - Cloth, paper, and other solid materials that have been soaked with flammable liquids must be placed in an approved container made of metal and fitted with a cover. The container must be properly labeled and emptied daily.

9. NEVER pour combustible or flammable liquid waste into sinks or floor drains that go to sanitary or sewer facilities.





10. NEVER point a spray gun at any part of the human body, especially when the nozzle is removed. The extreme force of the spray will penetrate and tear the skin, causing severe injury.

11. NEVER attempt to change the spray tip or gun without first relieving the air pressure or disengaging the spray gun trigger. The pressure could shoot the nozzle tip and retainer nut like a bullet. The paint or liquid under high pressure may split the human skin or damage bones.

REFERENCES

Materials were selected and reviewed from the following sources and in some instances were incorporated in the production of the preceding unit.

Binks Mfg. Company, P.O. Box 66090, Chicago, IL 60666

NIOSH

OSHA

CHEMICALS

COMMON ORGANIC SOLVENTS like benzene, methyl alcohol, acetone, and many others can have a serious toxic effect if inhaled over an extended period. Their use requires good window ventilation or a fume hood.

PTC PAPERS are normally used in biology programs. A cautious attitude is advised toward the use of PTC (phenylthiocarbamide or phenylthiourea) taste papers. The PTC test papers are used to illustrate the genetic transmission of the ability to taste the compound within a family. The FDA has not approved PTC. The substance is described as a rodenticide in Dangerous Properties of Industrial Chemicals. According to the Merck Index, the lethal dose for rats is 40 mg/kg of body mass.

CHRONIC PENCIL CHEWERS may be getting lead poisoning from the paints used on some pencils.

CARBON TETRACHLORIDE is extremely poisonous and is rapidly absorbed by the body both in liquid and vapor form. It was banned from sale for home use by the FDA in 1971. Most poisonings are due to inhaling fumes. The recommended safe tolerance for air is 10 ppm (parts per million). However, it is not detected by smell until the concentration in the air reaches 80 ppm. It can cause acute liver damage and kidney failure. Some individuals are more susceptible than others depending upon age, obesity, and general health. No specific treatment or antidote is known. Almost all body cells are affected by the toxin. Most school laboratories' chemical supplies contain carbon tetrachloride. It should be used only when absolutely necessary and with extreme caution in a well-ventilated area. It should never be used as a fire extinguishing medium or as an agent in insect-killing containers.

POTASSIUM CHLORATE is one of the most frequent causes of serious explosions because of its strong oxidizing power and sensitivity to shock. Slight amounts of combustible impurities like carbon or sulfur may cause an explosion through mild friction or impact. Potassium chlorate should be tested for impurities before it is used in demonstrations or class experiments. This can be done with small amounts and well in advance of usage. Some chemists have suggested eliminating it from school laboratory shelves completely.

CHEMICALS THAT ARE ACTIVE ON WATER like hydrogen peroxide, calcium carbide, and calcium oxide should be kept in airtight and waterproof containers when not in use in order to avoid fire or explosion. Calcium carbide, in addition, produces highly combustible acetylene when reacting with water. If sodium or potassium is used, pupils should be cautioned about handling it. The teacher should dispense these metals in small pieces. Pupils should not have access to large chunks of these metals. The temptation to use too much is hard to overcome. The pupils should also be warned about the spattering of sodium.

AMMONIUM DICHROMATE to simulate volcanic eruptions in volcano models is hazardous. The compound is toxic, flammable, and may react explosively with certain organic compounds. It should be kept in a tightly-closed container and away from an open flame. The vapors may have a corrosive action on the skin and mucous membranes, causing a rash or external ulcers. Ammonium dichromate can emit highly-toxic fumes when heated. A substitute for this compound is strongly recommended for such a demonstration.

CHLORINE GAS is very poisonous and hence should be made only in small quantities. Only the most reliable pupils should be permitted to perform the experiment of making the gas, and then, only after having been specifically advised as to the hazards involved. One generator may be set up on each table or in hood compartments. Adequate ventilation must be provided to prevent the accumulation of dangerous quantities of the gas in the room. The experiment should be closely supervised by the teacher at all times.

U.S. CONSUMER PRODUCT SAFETY COMMISSION
KANSAS CITY REGIONAL OFFICE
1221 BALTIMORE, SUITE 1000
KANSAS CITY, MISSOURI 64105

Telephone
816-374-2034

May 23, 1980

C. Smiley Ebert
Director
Wichita Public Schools
Division of Vocational and Continuing Education
Vocational-Technical Center
301 South Grove
Wichita, Kansas 67211

Dear Smiley:

I appreciate your interest and concern in the product safety area. It is commendable that you and your staff have "done" something about reducing the problems of injuries and accidents in school by developing The Kansas State Safety Education Guide.

Regarding the section(s) mentioning the Consumer Product Safety Commission, these are our recommendations:

> Since the products carbon tetrachloride, asbestos, and benzene have all been reviewed separately from a hazard standpoint, there have been different actions taken by the Commission on their status. Specifically, The Consumer Product Safety Commission has banned most consumer products containing carbon tetrachloride.
>
> The Commission is currently considering proposing a ban on the chemical benezene.
>
> As far as asbestos is concerned, CPSC is investigating and will be regulating the use of asbestos in consumer products where warranted.

If you have any further questions, please feel free to call me.

Sincerely,

Bob R Baxter

Bob R. Baxter
Public Information Officer

CARCINOGENS

In January 1975, the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), declared 14 chemicals to be cancer-causing substances (carcinogens).

These compounds should be safely stored or disposed of if they are among the school science laboratory supplies. The only exception to the ban on their use in the science program should be if they are absolutely essential for special projects under strict personal supervision by a certified science teacher who is knowledgeable in the handling and use of such compounds. These compounds are extremely toxic; even at levels of one part per billion (1 ppb). The toxic effects of these compounds in humans may not show up for 20 years or more.

Listed below are the 14 carcinogens discussed above:

1. 4-Nitrobiphenyl (4-NBP)

   Other names include: 4-Nitrodiphenyl; p-Nitrobiphenyl; and p-Nitrodiphenyl.

2. Alpha-Naphthylamine (1-NA)

   Other names include: 1-NA; Naphthylamine; Fast Garnet Base B; Antioxidant Mb; 1-Aminonaphthalene; Naphthalidam; and Naphthalidine.

3. 4,4'-Methylene bis (2-chloroaniline)

   Other names include: MOCA.

4. Methyl chloromethyl ether (CMME)

   Other names include: chlorodimethyl ether; chloromethyl ether; and chloromethyl methyl ether.

5. 3,3' Dichlorobenzidine (and its salts)

   Other names include: 4,4' Diamino; 3,3'-Dichlorobiphenyl; 4 4' Diamine; 0,0'-Dichlorobenzidine; and similar names.

6. Bis (chloromethyl) ether (BCME)

Other names include: Chloro (chloromethoxy) methane; sym-Dichloromethyl ether; and similar names.

7. Beta-Naphthylamine (2-NA)

8. Benzidine

Other names include: Fast Corinth Base B; p-Diaminodiphenyl; 2-Aminodiphenyl; C.1. Azoic Diazo Component 112; p-p'-Bianiline; Benzidine dihydrochloride; Benzidine sulfate; and 4-4' Diaminobiphenyl.

9. 4-Aminodiphenyl

Other names include: 4-ADP; PAB; Biphenyline; P-Phenylaniline; Xenylamine; P-Aminobiphenyl; and other names.

10. Ethyleneimine (EI)

Other names include: Azirane; Azacyclopropane; Aziridine; Dimethyleneimine; Dihydroazirine; and similar names.

11. Beta-Propiolactone (BPL)

Other names include: Betaprone (a trademark); 2-oxetanone; propiolactone; B-lactone hydrocrylic acid; 3-Hydroxypropionic acid lactone; and similar chemical names.

12. 2-Acetylaminofluorene

Other names include: AAF; 2-AAF; FAA; 2-FAA; 2-Fluorenylacetamide; 2-Acetamidofluorene; and N-Acetylaminophenathrene.

13. 4-Dimethylaminoazobenzene (DAB)

Other names include: Solvent Yellow 12; Fat Yellow; Oil Yellow; Cerasine Yellow; DMAB; Brilliant Fast Spirit Yellow; Methyl Yellow; N; Aniline; N-dimethyl-p-(Phenylazo); Benzeneazc Dimethylaniline; and similar names.

14. N-Nitrosodimethylamine (DMN)

Other names include: Dimethylamine; Nitrous dimethylamide; N, N-Dimethylnitrosoamine; Dimethylnitramine; and similar names.[1]

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[1] Carcinogens, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, 1977 price $0.50, stock #029-015-0047.

INCOMPATIBLE CHEMICALS

The following is a partial list of chemicals commonly found in school laboratories. Many chemicals react violently, produce toxic fumes, and are fire hazards when they interact. The chemicals listed in the left-hand column should be stored in a manner that will prevent them from coming in contact with those in the righ-hand column.

Acetic acid	Chromic acid, nitric acid, perchloric acid, ethylene glycol, hydroxyl compounds, peroxides, and permanganates
Acetone	Concentrated sulfuric and nitric acid mixtures
Acetylene	Bromine, chlorine, fluorine, copper tubing, as well as silver, mercury, and their compounds
Alkali metals (K, Na, Ca), powdered aluminum, and magnesium	Water, carbon dioxide, carbon tetrachloride, and the halogens
Ammonia, anhydrous	Mercury, hydrogen fluoride, and calcium hypochlorite
Ammonium nitrate (a deliquescent, hygroscopic, powerful oxidizing agent)	Strong acids, metal powders, chlorates, nitrates, sulfur, flammable liquids, and finely-divided organic materials.
Aniline	Nitric acid and hydrogen peroxide
Bromide	Ammonia, acetylene, butane, hydrogen, sodium carbide, turpentine, and finely-divided metals
Carbon, activated	Calcium hypochlorite, all oxidizing agents

Chlorates	Ammonium salts, strong acids, powdered metals, sulfur, and finely-divided organic materials
Chromic acid	Glacial acetic acid, camphor, glycerin, naphthalene, turpentine, lower molecular weight alcohols, and many flammable liquids
Chlorine	Same as for bromine
Copper	Acetylene and hydrogen peroxide
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, sodium peroxide, nitric acid, and the halogens
Hydrocarbons (butane, propane, benzene, gasoline, and turpentine)	Fluorine, chlorine, bromine, chromic acid, and sodium peroxide
Hydrofluoric acid	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, (most metals or their salts), flammable liquids, and other combustible materials
Hydrogen sulfide	Nitric acid and certain oxidizing gases
Iodine	Acetylene and ammonia
Nitric acid	Glacial acetic acid, chromic and hydrocyanic acids, hydrogen sulfide, flammable liquids, and flammable gases which are easily nitrated
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, and gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohols, paper, wood, and other organic materials
Phosphorus pentoxide	Water
Potassium permanganate	Glycerin, ethylene glycol, and sulfuric acid

Silver	Acetylene, ammonia compounds, oxalic acid, and tartaric acid
Sodium peroxide	Glacial acetic acid, acetic anhydride, methanol, carbon disulfide, glycerin, benzaldehyde, and water
Sulfuric acid	Chlorates, perchlorates, permanganates, and water

Note: A copy of the Manual of Hazardous Chemical Reactions is recommemded for high school science departments. The 470-page book (491M) is available for $5.00 (1977 price) from the National Fire Protection Association, 470 Atlantic Avenue, Boxton, MA 02210.

State of Kansas . . . John Carlin, Governor

DEPARTMENT OF HEALTH AND ENVIRONMENT

Joseph F. Harkins, Secretary

Forbes Field
Topeka, Kansas 66620
913-862-9360

Dear Kansas Educators:

The problem of chemical waste disposal has now become one of the most serious problems facing the nation. During the past three years the Kansas Legislature has passed stringent laws and regulations for disposal of chemical waste in Kansas. It is unlawful by K.S.A. 1979 Supp. 65-3409 to indiscriminately dispose of chemicals upon the surface of the ground, into the ground or into the waters of the state. Chemical wastes can only be disposed in facilities permitted by the department. Violations of this law are subject to a civil penalty of five hundred dollars ($500) for each violation and punishable as a class A misdemeanor. Under no circumstances should waste chemicals be dumped into ditches, farm fields, and abandoned wells, etc. Attached is a copy of the Kansas Law and Regulations for your reference.

The following pages outline the only approved procedures to dispose of chemical wastes in Kansas. If we can be of any further assistance, please contact me.

Sincerely yours,

Division of Environment

John Paul Goetz

John Paul Goetz, P.E.
Environmental Engineer
Solid Waste Management Section
Bureau of Environmental Sanitation

mw

DISPOSAL OF BULK AND ACCUMULATED QUANTITIES OF CHEMICALS

This part should serve as a guide for disposal of any one laboratory chemical in a quantity greater than 100 milliliters or an accumulated quantity of different chemicals totaling greater than 1 kilogram. This applies particularly to those laboratories where housecleaning and disposal of stockpiled chemicals on a one-time basis is involved. The disposal of laboratory chemicals from daily laboratory use or spills in quantities less than above are addressed in Part II of this unit.

In order to limit the quantity of chemicals which require disposal, it is strongly recommended that you avoid buying large quantities of a chemical at a reduced price if no planned use for that material is anticipated. It is our experience that chemicals bought in this manner end up being disposed.

Never dispose of a chemical in an unapproved manner or location. This includes lakes, wells, fields, roadside ditches, etc. Disposal of chemicals in this manner subjects you or your employer to enforcement actions by both federal and state authorities. Additionally, you could cause serious harm or injury to unknowing persons who might discover such chemicals. You could be liable for any damages or injuries.

The following outlines the accepted procedure for disposal of bulk chemicals in the State of Kansas:

1. Prepare an inventory of all chemicals both known and unknown which require disposal. This inventory must include the following information:

    a. Identification of the chemical (if unknown describe to the best of your ability).

    b. Quantity

    c. Physical form (liquid, solid, gaseous)

    d. Condition of storage container

2. Contact the following, either by telephone or in writing upon completion of inventory:

    John Paul Goetz
    Kansas Department of Health and Environment
    Bureau of Environmental Sanitation
    Forbes Field
    Topeka, Kansas 66620
    Telephone: 913-862-9360, extension 297

3. The contact will review the list and advise you of where each chemical can be disposed. For those chemicals approved for disposal in the county sanitary landfill, refer to paragraph 4 for handling procedures. The chemicals which are considered highly hazardous due to either physical condition or toxicity will be handled on a case-by-case basis. In some instances, the department will seek outside help in assisting you during the disposal process.

4. Disposal procedure for use of a county sanitary landfill:

   a. Carefully package all approved chemicals in separate containers or boxes. You should provide adequate packing and separate the chemicals into the following general categories:

      i) Acidic Chemicals
      ii) Basic Chemicals
      iii) Organic Chemicals
      iv) Miscellaneous

      Remember to avoid mixing cyanide compounds with acid chemicals.

   b. Liquids in containers greater than five gallons should not be packaged as described in section (a). These chemicals should be handled separately and disposed according to instructions provided by the Department of Health and Environment.

   c. Never dispose of waste chemicals by dumping into a trash collection container. This is dangerous for those people involved in collecting and transporting solid waste.

   d. Always contact the landfill operator and arrange to deliver the chemicals yourself or someone designated by you. Refer to the following list of approved landfills for locations and contacts.

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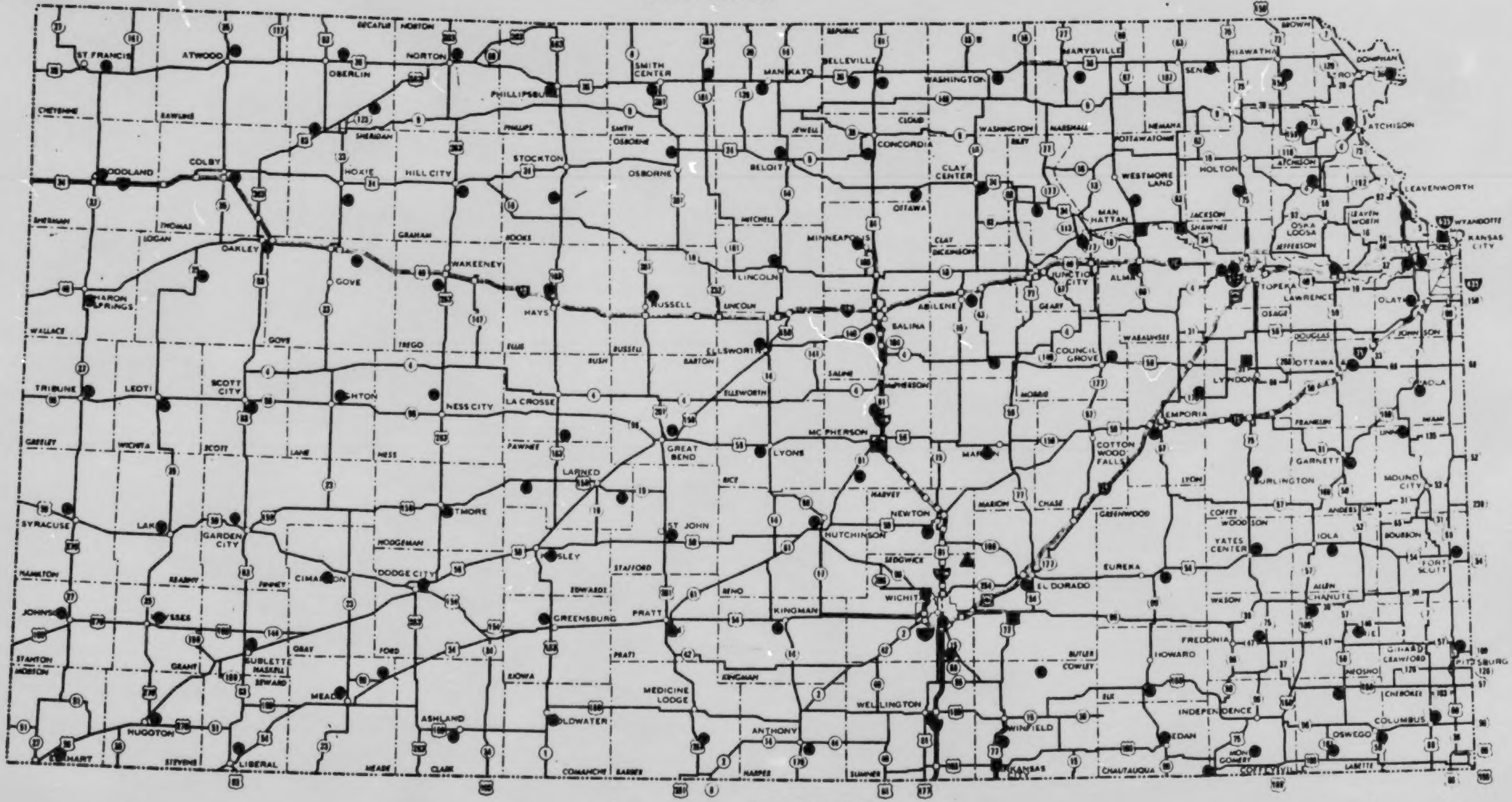
PERMITTED SOLID WASTE DISPOSAL SITES AND TRANSFER STATIONS

KANSAS


ST FRANCIS
ATWOOD
OBERLIN
NORTON
PHILLIPSBURG
SMITH CENTER
MANKATO
BELLEVILLE
WASHINGTON
MARYSVILLE
SENECA
HIAWATHA
TROY
ATCHISON
CHEYENNE
RAWLINS
DECATUR
SHERIDAN
PHILLIPS
SMITH
JEWELL
REPUBLIC
CLOUD
NEMAHA
BROWN
DONIPHAN
GOODLAND
COLBY
HOXIE
HILL CITY
STOCKTON
OSBORNE
BELOIT
CONCORDIA
CLAY CENTER
WESTMORELAND
HOLTON
LEAVENWORTH
SHERMAN
THOMAS
GRAHAM
ROOKS
OSBORNE
MITCHELL
OTTAWA
POTTAWATOMIE
JACKSON
ATCHISON
JEFFERSON
WYANDOTTE
KANSAS CITY
LOGAN
OAKLEY
GOVE
WAKEENEY
MINNEAPOLIS
MANHATTAN
OSKALOOSA
SHARON SPRINGS
HAYS
RUSSELL
LINCOLN
JUNCTION CITY
ALMA
TOPEKA
LAWRENCE
OLATHE
WALLACE
TREGO
ELLIS
RUSSELL
ELLSWORTH
SALINA
ABILENE
GEARY
WABAUNSEE
SHAWNEE
DOUGLAS
JOHNSON
TRIBUNE
LEOTI
SCOTT CITY
DIGHTON
NESS CITY
LA CROSSE
RUSH
BARTON
SALINE
COUNCIL GROVE
LYNDON
OTTAWA
PAOLA
GREELEY
WICHITA
SCOTT
LANE
NESS
PAWNEE
GREAT BEND
MC PHERSON
LYONS
MARION
MORRIS
EMPORIA
FRANKLIN
MIAMI
LARNED
RICE
HARVEY
COTTONWOOD FALLS
LYON
GARNETT
BURLINGTON
LINN
MOUND CITY
SYRACUSE
LAKIN
GARDEN CITY
JETMORE
HODGEMAN
ST JOHN
HUTCHINSON
NEWTON
MARION
CHASE
GREENWOOD
COFFEY
WOODSON
ANDERSON
BOURBON
FORT SCOTT
HAMILTON
KEARNY
FINNEY
CIMARRON
DODGE CITY
KINSLEY
STAFFORD
EDWARDS
RENO
SEDGWICK
WICHITA
EL DORADO
EUREKA
YATES CENTER
IOLA
ALLEN
CHANUTE
JOHNSON
ULYSSES
GRAY
FORD
GREENSBURG
PRATT
KINGMAN
WILSON
FREDONIA
GIRARD
CRAWFORD
PITTSBURG
STANTON
MORTON
GRANT
SUBLETTE
HASKELL
KIOWA
BUTLER
COWLEY
HOWARD
NEOSHO
ELK
SEWARD
MEADE
MEDICINE LODGE
WELLINGTON
INDEPENDENCE
CHEROKEE
COLUMBUS
HUGOTON
ASHLAND
COLDWATER
ANTHONY
WINFIELD
SEDAN
MONTGOMERY
OSWEGO
ELKHART
LIBERAL
STEVENS
CLARK
COMANCHE
BARBER
HARPER
SUMNER
ARKANSAS CITY
CHAUTAUQUA
COFFEYVILLE
LABETTE

Legend
- ● - Sanitary Landfill
- ▲ - Hazardous Waste Facility
- ■ - Transfer Station
- ☐ - Solid Waste Processing Facility

SANITARY LANDFILLS

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Allen County	101	Allen Co. Commission Courthouse Iola, Kansas 66749 316-365-2261	1.5 mi. S & 7 mi. E of 169 & 54 Jct. in Iola, Kansas
Anderson County	147	Anderson Co. Commission Courthouse Garnett, Kansas 66032 913-448-3724	0.5 mi. E of 169 & 59 Jct. at S edge of Garnett
Atchison County (Atchison Site)	260	Joe Lane, S.W.D. Courthouse Atchison, Kansas 66002 913-367-4978	1 mi. N & 5 mi. W of Atchison on hi-way 73
(Effingham Site)	233		0.5 mi. W & 2 mi. N of Effingham on Hiway 9
Barber County	102	Leroy Willis, Co. Eng. Courthouse Medicine Lodge, KS. 67104 316-886-3213	11.5 mi. S of 281 & 160 Jct.
Barton County	103	M. Doolen Edman, S.W.D. Courthouse Great Bend, KS 67530 316-792-4991	2.5 mi. W & 3 mi. N of 156 & 56 Jct.
Bourbon County	206	Lewis Shields, Co. Eng. Courthouse Ft. Scott, Kansas 66701 316-223-1320	0.5 mi. E, 0.5 mi. N, 0.5 mi. E of 54 & 69 Jct. on N edge of Ft. Scott, KS
Brown County	104	Brown County Commission Courthouse Hiawatha, KS 66434 913-742-2581	1.5 mi. E & 5 mi. S of 36 & 159 Jct. in Hiawatha

S.W.D. - Solid Waste Director

D.P.W. - Director of Public Works

LANDFILLS	PERMIT NO	OPERATOR	LOCATION
Butler County	100	Ted Farmer, Co. Eng. Courthouse El Dorado, KS 67042 316-321-3010	3.5 mi. S & 2.5 W of 54 & 77 Jct. in El Dorado, KS
Chase County		Refer to Morris County	
Chautauqua Co.	286	Larry Loftin, Rd. Supv. Courthouse Sedan, KS 67361 316-725-3370	0.5 mi. W of 166 & 99 Jct. at W edge of Sedan, KS
Cherokee County	179	James Burgan Box 98 Scammon, KS 66773 316-479-6131	4.5 mi. N of Columbus on hiway 7
Cheyenne County	166	Wayne Ritchey, Co. Eng. Courthouse St. Francis, KS 67756 913-332-2621	0.5 mi. N & 2 mi. E of 217 & 36 Jct.
Clark County	106	Virgil Chapman, Co.Eng. Courthouse Ashland, KS 67831 316-635-2832	1 mi. W of the south edge of Ashland,KS
Clay County	231	Don Jasperson, Co. Eng. Courthouse Clay Center, KS 67432 913-632-3456	S of fairgrounds - SE edge of Clay Center, KS
Cloud County	107	Doyle Turner, Co. Eng. Courthouse Concordia, KS 66901 913-243-4396	1.5 mi. W & 4.5 mi. S of 81 & 9 Jct. in Concordia, KS
Cloud County	244	City of Miltonvale c/o City Clerk City Hall Miltonvale, KS 67466 913-427-2640	1.5 mi. S of 24 & 189 Jct. on N side of Miltonvale,KS
Coffey County	297	John Callahan, E.I.T. Courthouse Burlington, KS 66839 316-364-2441	1 mi. E, 0.5 mi. N & 1 mi. E. of Burlington, KS

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Comanche County	108	Loyd Ward, Rd. Supr. Courthouse Coldwater, Kansas 67029 316-582-2933	0.5 mi. E & 3 mi. S of 160 & 183 Jct.
Cowley County	148	Kenneth Watts, Co. Eng. Courthouse Winfield, KS 67156 316-221-4066	2 mi. E & 6 mi. N of 166 & 77 Jct. in Arkansas City, KS
Cowley County	284	City of Atlanta c/o City Clerk City Hall Atlanta, KS.67008 316-394-2430	between 2nd & 3rd sts W of Spruce
Crawford County	317	Crawford Co. Commission Courthouse Girard, KS 66743 316-724-6115	1.5 mi. E & 1 mi.S of 57 & 69 Jct.
Decatur County	217	City of Jennings c/o City Clerk City Hall Jennings, KS 67643 913-678-2365	0.5 mi. S of the city limits
Decatur County	150	Melvin Kincaid, Rd.Supr. Courthouse Oberlin, KS 67749 913-475-3041	5 mi. E. of 36 & 83 Jct.
Dickinson County (Abilene Site)	109	James Hague, Co. Eng. Courthouse Abilene, KS 67410 913-263-3093	SW corner of Buckeye Rd. Exit, 2.5 mi E of I-70 & 15 Jct.
(Hope Site)	110		2.5 mi. E. of 43 & 4 Jct. in Hope, KS.
Doniphan County	111	Raymond Neely, Rd. Supr. Courthouse Troy, KS 66087 913-985-3535	0.5mi. W of Wathena on Hiway 36

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Douglas County (City of Lawrence)	186	George Williamson City Hall Lawrence, Kansas 66044 913-841-7700	1.5 mi. W & 2 mi. N of 59 & 24 Jct. in Lawrence, KS
Edwards County	112	Kenneth Dupree, Rd. Supr. Courthouse Kinsley, KS 67547 316-659-2188	0.5 mi. S & 4.5 mi. E of 50 & 18e Jct.
Elk County	161	Elk County Commission Courthouse Howard, KS 67349 316-374-2490	0.5 mi. S & 1 mi. E of Eastern 160 & 99 Jct.
Ellis County	113	Ellis Co. Commission Courthouse Hays, KS 67601 913-625-7334	1.5 mi. W & 1 mi. N of I-70 & 183 Jct.
Ellsworth County	114	William Handlin, Rd. Supt. Courthouse Ellsworth, KS 67439 913-472-4003	0.5 mi W, 1 mi. N & 1 mi. W. of 140 & 156 Jct.
Finney County	277	H. Rex Brunson, Co. Eng. Courthouse Garden City, KS 67846 316-275-7178	2.25 mi. W & 2 mi. N of the northern 83 & 50 Jct.
Ford County	175	Dale Smith, Co. Eng. Courthouse Dodge City, KS 67801 316-225-4861	1.5 mi. N of 50-56 & 154 Spur
Franklin County	159	Craig Santarpia, Co.Eng. Courthouse Ottawa, KS 66067 913-242-2979	0.5 mi. E. 0.5 mi. N & 0.5 mi. E of I-35 & 68 Jct on E side of Ottawa, KS
Geary County	312	Bill Metcalf, Co., Eng. Courthouse Junction, City, KS 66441 913-238-3912	0.5 mi. S of 207 & I-70 Jct.
Gove County	115	Cloyce Randall, Co. Eng Courthouse Gove, KS 67736 913-938-2871	0.25 mi. W & 1.5 mi. S of I-70 and 211 Jct.

LANDFILLS	PERMIT NO	OPERATOR	LOCATION
Graham County	116	Gary Cameron, Co. Eng. Courthouse Hill City, KS 67642 913-674-2651	0.5 mi. E & 2 mi. S of 24 & 283 Jct.
Grant County	207	City of Ulysses c/o Harold Bair, City Adm. City Hall Ulysses, KS 67880 316-356-4600	2.5 mi. E of 25 & 160 Jct.
Gray County	116	Gray Co. Commission Courthouse Cimarron, KS 67835 316-855-3815	1.5 mi. S of Ingalls city limit
Greeley County	253	Ray H. Wetzel, Rd. Supv. Courthouse Tribune, Ks. 67879 316-376-4253	0.5 mi. E & 1 mi. N of 96 & 27 Jct.
Greenwood County	118	Harry Meadows, Rd. Supvr. Courthouse Eureka, KS 67045 316-583-6241	2 mi. E & 1 mi. S of the eastern 99 & 54 Jct.
Hamilton County	182	City of Syracuse c/o John Armstrong, City Supt., City Hall Syracuse, KS 67878 316-384-7818	1 mi. N of 27 & 50 Jct.
Harper County	208	Harper Co. Commission Courthouse Anthony, KS 67003 316-842-5240	2 mi. E of 179 & 44 Jct.
Harvey County	119	Karl J. Svaty, Co., Eng. Courthouse Newton, KS 67114 316-283-7232	0.5 mi. W, 1 mi. S & 2.5 mi. W of southern 50 & 15 Jct.
Haskell County	254	Ted Burland, Co. Eng. Courthouse Sublette, KS 67877 316-675-2234	NE edge of Sublette city limits

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Hodgeman County	120	Hodgeman Co. Commission Courthouse Jetmore, KS 67854 316-357-8346	0.5 mi. E, 0.5 mi. S & 1 mi. E of 283 & 156 Jct.
Jackson County	257	Raymond Jackman, S.W.D. Courthouse Holton, Kansas 66436 913-364-2358	3 mi. W & 8 mi. S of 75 & 16 Jct. in Holton, KS.
Jefferson County	261	City of Valley Falls c/o City Clerk Valley Falls, KS 66088 913-945-6612	1 mi. N & 4.5 mi. E of 16 & 4 Jct. in Valley Falls, KS
Jewell County	165	Warren Hardin, Co. Eng. Courthouse Mankato, KS 66956 913-378-3431	0.5 mi. S & 3.5 mi. W of 36 & 14 Jct.
Johnson County	247	City of Olathe c/o Bob Hansen, San. Supt. City Hall Olathe, KS 66061 913-782-2600	1 mi. N. & 1 mi. W of 7 & 150 Jct. in Olathe
Johnson County	263	Deffenbaugh Disp. Ser.,Inc. 18181 W. 53rd St. Shawnee, KS 66203 913-631-3000	0.5 mi. W & 2 mi. N of hiway 10 & Renner Rd. Jct.
Kearny County	121	Paul McVey,Co.Eng. Courthouse Lakin, KS 67860 316-355-6571	1 mi. N & 2.5 mi.W of 25 & 50 Jct.
Kingman County	122	Charles Arensdorf,S.W.D. 823 Avenue A East Kingman, KS 67068 316-532-5311	1.5 mi. W & 3 mi. S of 54 & 14 Jct.
Kiowa County	281	James Dighton, Co.Eng. Courthouse Greensburg, KS 67054 316-723-2531	2 mi. N of 54 & 183 Jct.

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Labette County	239	City of Oswego c/o City Clerk City Hall Oswego, Kansas 67356 316-795-4433	0.25 mi. E & 2 mi.S of 59 & 96 Jct. in Oswego
Labette County	279	Beachner Const.Co.,Inc. Box 128 St. Paul, KS 66771 316-449-2286	0.25 mi. W & 4 mi. S of 160 & 59 Jct. in Parsons
Labette County	300	City of Edna c/o City Clerk City Hall Edna, Kansas 67342 No Phone	5 mi N of 101 & 166 Jct.
Lane County	123	St. Clair Rowe, Co.Eng. Courthouse Dighton, KS 67839 316-397-5651	0.5 mi. S, 2 mi. E & 1 mi. N of 96 & 23 Jct.
Leavenworth County	155	City of Leavenworth Robert Patzwald, San. Dir. City Hall Leavenworth, KS 66048 913-682-9201	0.5 mi. E & 8 mi. N of 24 & 73 Jct.
Lincoln County	124	Neil Maholland, Rd.Supr. Courthouse Lincoln, KS 67455 913-524-4443	0.5 mi. N & 2 mi. W of 18 & 14 Jct.
Linn County	180	Solid Waste Systems, Inc. Rural Route #1 Fontana, Kansas 66026 913-849-3360	0.5 mi. W & 3 mi. N of 135 & 7 Jct.
Logan County	125	Jerry Wright, Co. Eng. Courthouse Oakley, Kansas 67748 913-672-4504	6.5 mi S of the western 40 & 25 Jct.
Logan County	221	City of Oakley c/o Francis Salisbury, Util. Supt. City Hall Oakley, Kansas 67748 913-672-3611	0.5 mi. E & 1 mi.S of 40 & 83 Jct.

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Lyon County	145	City of Emporia c/o Lee Stolfus, D.P.W. City Hall Emporia, KS 66801 316-342-9171	1 mi. W. 0.5 mi. S & 1.5 mi. W of 99 & 50 Jct in Emporia
Lyon County	215	City of Reading c/o City Clerk City Hall Reading, KS 66868 316-699-3870	0.5 mi. N. & 0.5 mi. W of Reading city limits
Marion County	158	Charles Penner,Co.San. Courthouse Marion, KS 66861 316-382-2550	2.5 mi S & 3 mi W of Marion, KS
Marshall County	127	Warren Woods, Co.Eng. Courthouse Marysville, KS 66508 913-562-2941	0.5 mi. W & 5 mi. S of Home City, KS
McPherson County	126	Melvin Ferguson.Co.Eng. Courthouse McPherson,KS 67460 316-241-0466	0.5 mi. E & 6.5mi S of Lindsborg
McPherson County	187	City of Inman c/o Loren Lindholm,St.Supt. City Hall Inman, KS 67546 316-585-2122	North edge of city limits on east side railroad tracks
McPherson County	173	McPherson Refuse Serv. c/o Howard Schmidt Box 187 McPherson,KS 67460 316-241-0077	1 mi. S & 0.5 mi. W of I-35W & 56 Jct.
Meade County	128	Michael Gamble, Co.Eng. Courthouse Meade, KS 67864 316-873-2481	2.5 mi. N of 54 & 23 Jct.
Meade County	270	City of Fowler c/o City Clerk City Hall Fowler, KS 67844 316-646-5231	1.5 mi. E of 54 & 98 Jct.

LANDFILLS	PERMIT No.	OPERATOR	LOCATION
Miami County	256	H.Y. Fortenberry,Co.Eng. Courthouse Paola, KS 66071 913-294-4377	1.5 mi. E & 2 mi.S of Paola city limits
Mitchell County	129	John Cashett, Co.Eng. Courthouse Beloit, KS 67420 913-738-3644	1 mi. N & 2 mi W 24 & 14 Jct
Montgomery County	276	Herb Callon, Co.Eng. Courthouse Independence,KS 67301 316-331-0630	1 mi. W & 2.5mi N of Dearing
Montgomery County	156	City of Caney c/o Don Graham City Hall Caney,Ks. 67333 316-879-2772	1 mi. S & 1 mi. W of 166 & 75 Jct. on N side of Caney,Ks.
Morris County	130	Morris County Comm. Courthouse Council Grove,KS 66846 316-767-5518	2 mi E of 56 & 57 Jct. in Council Grove
Morton County	197	W.D. Hershey, S.W.D. Courthouse Elkhart, KS 67950 316-697-2559	0.5 mi. S & 8 mi. W of 56 & 51 Jct.
Nemaha County	224	Kenneth Nolte, Co.Eng. Courthouse Seneca, KS 66538 913-336-2168	1.5 mi. E of 236 & 36 Jct.
Neosho County	146	Charles Ingle, Co.Eng. Courthouse Erie, KS 66733 316-244-3273	0.25 mi. N & 2 mi.E of 108 & 59 Jct. at W edge of Erie
Neosho County	274	City of Chanute c/o James Beck, City Eng. City Hall Chanute,KS 66720 316-431-3200	1.5 mi. E & 1 mi.S of 169 & 39 Jct. in Chanute,Ks.

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Ness County	162	George Prose,Co.Eng. Courthouse Ness City, KS 67560 913-798-3350	0.5 mi. W & 6 mi. N of 96 &283 Jct.
Norton County	131	Vernon Bogart, Co.Eng. Courthouse Norton, KS 67654 913-877-2401	1 mi N & 1 mi E of 36 & 283 Jct.
Osage County	Refer to Transfer Station Section		
Osborne County	184	Ralph Campbell,Co.Eng. Courhouse Osborne, KS 67473 913-346-2153	1 mi. S of the northern 24 & 381 Jct.
Ottawa County	132	Bob Lott, S.W.D. Courthouse Minneapolis.KS 67467 913-392-3037	0.5 mi. W. 1 mi. N, 4 mi. W, 2 mi. N & 2 mi W of 81 & 106 Jct.
Pawnee County (Larned Site)	133	James Walker, Co. Eng. Courthouse Larned, KS 67550 316-285-3761	1 mi. S, 7 mi. E & 1 mi S of 56 & 19 Jct
(Burdett Site)	214		0.5 mi S & 2.5 mi E of Burdett,KS
Phillips County	149	City of Phillipsburg c/o City Clerk City Hall Phillipsburg, KS 67661 913-543-5234	1.5 mi. W & 1 mi S of the eastern 36 & 183 Jct.
Pottawatomie County	223	Victor Fincham, Co.Eng. Courthouse Westmoreland, KS 66549 913-457-3631	1 mi. N of Louisville on hiway 99 then 1 mi. N on county blacktop road
Pratt County	282	Dwight Hartman,Rd.Supr. Courthouse Pratt. KS 67124 316-672-2441	0.5 mi. S, 1 mi. E & 2 mi. S of 54 & 281 Jct.

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Rawlins County	134	Robert Clark,Co.Eng. Courthouse Atwood, KS 67730 913-626-3726	2.5 mi. N of 36 & 25 Jct.
Reno County	287	Charles Nunemaker,D.P.W. Courthouse Hutchinson, KS 67501 316-662-4411	2 mi. N & 3 mi. W of 50 & 17 Jct.
Republic County	136	Warren Hardin, Co.Eng. Courthouse Belleville, KS 66935 913-527-2235	0.5 mi. E, 3 mi. S & 1 mi. E of 81 & & 36 Jct.
Republic County	227	City of Scandia c/o City Clerk City Hall Scandia, KS 66966 913-335-2561	0.5 mi. W, 1 mi.S & 6 mi. W of 81 & 36 Jct.
Rice County	137	Jack Wray, Co.Eng. Courthouse Lyons, KS 67554 316-257-2231	2.25 mi. W of 56 & 14 Jct.
Riley County	185	Dan Hardin, Co.Eng. Courthouse Manhattan, KS 66502 913-776-4413	1 mi. S, 0.5mi. E, 1 mi. S. & 0.5 mi E of 113 & 18 Jct.
Riley County	309	City of Riley c/o City Clerk Box 102 Riley, KS 66531 913-485-2424	SW edge of city across Wild Cat Creek
Rooks County	183	Max Morgan, Co. Eng. Courthouse Stockton, KS 67669 913-425-6521	0.5mi. N, 0.5 mi.W & 5 mi. N of 18 & 183 Jct.
Rush County	169	Jim Melvin, Co.Eng. Courthouse LaCrosse, KS 67548 913-222-3118	2 mi. E & 7 mi. S of 96 & 183 Jct.

LANDFILLS	PERMIT NO.	OPERATOR	LOCATION
Russell County	139	D.K. Purdy, D.P.W. Courthouse Russell, KS 67665 913-483-4032	0.5 mi. E & 5 mi. N of Alt. 40 & 281 Jct.
Saline County	144	City of Salina c/o John Estes, Dir. Ser. City-County Building Salina, KS 67401 913-827-7131	5 mi. S & 2 mi W of I-35 W & 140 Jct.
Scott County	252	Paul Patton, Rd. Supr. Courthouse Scott City, KS 67871 316-872-2202	2.5 mi. E & 2 mi. S of 83 & 96 Jct.
Sedgwick County (Brooks Site)	213	City of Wichita c/o Ron Wilburn, Dir.San. City Hall Wichita, KS 67202 316-268-4408	0.5 mi. N. 1 mi E 2 mi. N. 0.5 mi. W of Zoo Blvd. & I-235
(Chapin Site)	212		0.5 mi. S, 1 mi. W & 0.5 mi. S of I-35 & 15 Jct.
Sedgwick County	236	Derby Landfill & Ref. Ser. c/o Jerry Engstrand 9201 S. 55th St. East Derby, Kansas 67037 316-788-3766	0.5 mi. W & 1 mi. S Derby, KS.
Seward County	140	Jim Habersat, Co. San. 310 East 5th Liberal, Kansas 67901 316-624-3742	2.5 mi E of 54 & 83 Jct.
Shawnee County	141	Shawnee County Refuse c/o Vick Hamersky, S.W.D. 9500 SW 21st St. Topeka, Kansas 66604 913-478-4423	5 mi. W of I 470 & 21st St. Jct.
Shawnee County	330	Topeka Waste Systems Topeka Air Fource Depot Topeka, KS 66619 913-862-0630	1 mi. W. & 1 mi. N of Elmont, KS on US 75 (7401 NW US 75 Hwy.)

LANDFILLS	PERMIT No.	OPERATOR	LOCATION
Sheridan County	181	Elmer Boxler, Co.Eng. Courthouse Hoxie, Kansas 67740 913-675-3261	5 mi. S of 23 & 24 Jct.
Sheridan County	283	City of Selden c/o City Clerk City Hall Selden, KS 67757 913-386-4263	0.5 mi. N & 2 mi. W of 83 & 23 Jct.
Sherman County	209	Larry Sears, S.W.D. Courthouse Goodland, KS 67735 913-899-5253	0.5 mi. E & 3.5 mi N of I-70 & 27 Jct.
Smith County	151	Paul A. Johnson, Co.Eng. Courthouse Smith Center, Kansas 66967 913-282-6542	0.5 mi. W of 36 & 204 Jct.
Smith County	183	City of Lebanon c/o City Clerk City Hall Lebanon, KS 66952 913-389-7703	0.5 mi. E & 1.5 mi N of 36 & 181 Jct.
Stafford County	142	Charles Ashley, Rd.Supr. Courthouse St. John, KS 67576 316-549-3597	0.5 mi. N, 1 mi. E & 2 mi. N of 50 & 281 Jct.
Stanton County	250	City of Johnson City c/o City Clerk City Hall Johnson City, KS 67855 316-492-2322	1 mi. W & 2 mi. N of 27 & 160 Jct.
Stevens County	143	Floid Bird, Co. Eng. Courthouse Hugoton, KS 67951 316-544-8782	0.5 mi. E of 25 & 56 Jct.
Sumner County	199	Milton Summers, Co.H.O Courthouse Wellington, KS 67152 316-326-2774	1 mi. S, 1 mi. E & & 1 mi. S. of the western 160 & 81 Jct.

LANDFILLS	PERMIT No.	OPERATOR	LOCATION
Thomas County	152	City of Colby c/o Robert Knabel, City Mgr City Hall Colby, Kansas 67701 913-462-3973	0.5 mi. S & 3 mi. E of 25 & 24 Jct.
Trego County	105	Cloyce Randall, Co. Eng. Courthouse Wakeeney, Kansas 67672 913-743-6441	0.5 mi. W & 4 mi S of I-70 & 283 Jct.

HAZARDOUS CHEMICALS
(SMALL QUANTITIES)

This unit suggest methods for dealing with the normal daily use of small quantities (less than 100 grams) of hazardous chemicals that are involved in established laboratory programs. It does not deal with the disposal of accumulated or bulk quantities (they are treated in the previous unit). It does not deal with ingestion. (If a chemical is ingested, contact the Poison Control Center immediately.)

This unit is depicted on tables. The hazard codes used in the table are identified below. Absence of an entry in any column does not necessarily imply that no information exists.

HAZARD CODE	NUMBER CODE	EXPLANATION
HEALTH - H		
	4	------A few whiffs of the gas or vapor could cause DEATH.
	3	------Materials extremely hazardous to health. Do not expose skin. Can cause serious injury despite medical treatment.
	2	------Materials hazardous. Treat promptly.
	1	------Materials only slightly hazardous. Can cause irritation if not treated.
	0	------No hazard.
FLAMMABILITY - F		
	4	------Very flammable gases or liquids. Dusts or mists form explosive mixtures with air.
	3	------Liquids which can be ignited under almost all normal temperature conditions. Water may be ineffective on these liquids because of their low flash points.
	2	-----Ignites if moderately heated.
	1	-----Ignites after considerable preheating.
	0	-----Will not burn.

HAZARD CODE	NUMBER CODE	EXPLANATION
REACTIVITY - R	4	Materials readily detonate or explode at normal temperature and pressure.
	3	These materials can explode but require a strong initiating force or heating in confinement.
	2	Materials are normally unstable but will not detonate. They can undergo reactions with the rapid release of heat.
	1	Materials are normally stable but may become unstable at high temperatures. May react with water, but not violently.
	0	Normally stable at all temperatures.

OTHER CODES USED IN THE TABLES ARE:

CODE NAME	LETTER/NUMBER	EXPLANATION
PERSONAL PROTECTION	A	Wear goggles and apron.
	B	Use hood or respirator.
	C	Wear gloves.
	D	Other (see "Remarks")
ANTIDOTE	W	Rinse immediately with large volumes of water.
	S	Wash with soap and water.
	O	Rinse with solvent specified in "Remarks."
	P	Consult a physician immediately.
EXTINGUISHING METHODS		(MOST CHEMICALS ARE CLASS B FIRES; A FEW ARE CLASS D.)
	1	Stop flow of gas. Use water to cool the exposed containers and to protect the persons effecting the shutoff. Use water spray to disperse gas or vapor.
	2	Use a dry chemical, "alcohol foam," or carbon dioxide. Water may be ineffective, but water should be used to keep the fire-exposed containers cool. If not ignited, water spray may be used to disperse the vapors of flush spills.

CODE NAME	LETTER/NUMBER	EXPLANATION
	3	Use a water spray, dry chemical, "alcohol foam," or carbon dioxide. Water may be used to flush the spills and disperse the vapors.
	4	Use a dry chemical or carbon dioxide. Water or foam may be used with care. They cause frothing.
	5	Contact local fire department at once. Class D fires must be handled by professional firefighters. (WARNING: WATER CAUSES RELEASE OF FLAMMABLE GAS.)
	6	Use water only.
DISPOSAL OF SMALL QUANTITIES		(NOTE: SMALL QUANTITIES MEAN LESS THAN 100 GM OF MATERIAL. IF THE AMOUNT IS LARGER, SEE "SPILLS" INFORMATION OR CONTACT THE SCIENCE COORDINATOR FOR PICK UP AND POSSIBLE REDISTRIBUTION.)
	W	This water-soluble material should be diluted and washed down the drain.
	E	This volatile material may be evaporated to dryness in the fume hood. Close the hood or do not use open flames in room.
	B	Flammable material may be safely burned in the hood.
	S	Treat this material the same way a spill would be treated. See the information code for "Spills."

DISPOSAL OF SPILLS

(NOTE: IF THE PROPER EQUIPMENT OR CHEMICALS ARE NOT AVAILABLE TO TREAT THE SPILL, LEAVE THE AREA IMMEDIATELY AND CONTACT THE LOCAL LAW ENFORCEMENT AGENCY OR FIRE DEPARTMENT.)

1A ORGANIC ACID HALIDES--Wear gloves and self-contained breathing apparatus. Cover with sodium bicarbonate. Scoop into a large beaker of water and let stand for ten minutes. Pour down the drain with large amounts of water. Wash the site with soapy water.

1B INORGANIC HALIDES--Same as above description 1A.

2 ALDEHYDES--Wear gloves, lab coat, and self-contained breathing apparatus. Eliminate all sources of ignition and flammables. (Small) Absorb on paper towel. Evaporate in fume hood, cover with screen, and burn paper. (Large) Cover with sodium bisulfite ($NaHSO_3$). Add small amounts of water and mix. Scoop into a beaker. Wait one hour then flush down the drain with a large excess of water. Wash the site with soap.

3 ALKALI AND ALKALI EARTH METALS—Wear leather gloves, large face shield, and laboratory coat. This method is intended for small quantities of material. Cover substance with dry Sodium Carbonate and mix well, then add the mixture to a volume of butyl alcohol large enough to cover the metal. Allow the mixture to stand for 24 hours undisturbed. After 24 hours dilute the mixture with very large quantities of water and put the mixture down the drain.

4A CHLOROHYDRINS AND NITROPARAFFINS--Wear gloves, coat and self-contained breathing apparatus. Eliminate all sources of ignition. Absorb on paper towel or vermiculite. Place on an iron or glass dish in the hood. Allow to evaporate. COVER the paper with a screen. Burn paper or vermiculite.

4B ORGANIC HALOGENS AND RELATED COMPOUNDS—Eliminate all sources of ignition. Absorb on paper towel or vermiculite. Place on an iron or glass dish in a hood. Allow to evaporate. Burn the paper or vermiculite. Wash site with soap and water.

4C HALOGENETED ACIDS--Eliminate all sources of ignition. Cover with sodium bicarbonate and vermiculite. Scoop into beaker of water. When reaction is complete flush down drain. Wash site with soap.

5 AROMATIC AMINES--Wear butyl rubber gloves, plastic apron, self-contained breathing apparatus. Absorb or brush onto paper. Place on iron pan in a fume hood to evaporate. Cover with a screen. Burn paper. Wash site with soap.

6 AROMATIC HALOGENATED AMINES AND NITRO COMPOUNDS--Wear butyl rubber gloves, lab coat, respirator, protect shoes. Absorb or sweep on paper towels and evaporate in hood. Wash site with soap. If spill is too large, absorb or mix with vermiculite, sand or sodium bicarbonate. Package in cardboard box and burn outside in an open pit.

7A ALIPHATIC AMINES--Wear butyl rubber gloves, face shield or all purpose respirator, lab coat. Cover with sodium bisulfate, spray with water and flush down drain with large volumes of water.

7B ORGANIC PHOSPHATES--Wear rubber gloves, self-contained breathing apparatus, lab coat. Absorb on vermiculite or paper towels. Place in plastic bag and burn in an incinerator. If incinerator is not available, place the bag in a pan of waste flammable solvent and burn.

8 AZIDES AND AZO COMPOUNDS--Wear leather gloves, heavy face shield, use body shield, avoid unnecessary heat or friction. (Note:--These compounds should not be in a school laboratory). Neutralize with 10% ceric ammonium nitrate solution, or 20% sodium nitrite solution, or absorb on paper and burn outside. Keep it moist while brushing onto paper.

9 CARBON DISULFIDE--Wear gloves, goggles, lab coat. Work in hood or use self-contained breathing apparatus. Carbon dioxide fire extinguisher should be available. Eliminate flammables and sources of ignition. Absorb on paper towels and evaporate in hood. Cover paper with a screen and burn in a hood.

10 CAUSTIC ALKALI AND AMMONIA--Wear rubber gloves, face shield (use special canister respirator for NH_3), lab coat. Solid--Sweep up, dilute and neutralize with 6M-Hcl in a large bucket. Wash down drain with large excess of water. Solution--Neutralize as above and mop up or use water vac. Wash down drain.

11 INORGANIC SALTS--Wear gloves, goggles, lab coat. Solutions--Cover with sodium carbonate, mix and scoop into beaker. Neutralize with 6m HCl and wash down drain. Solids--collect in beaker, dissolve in water and treat as above.

12A **OXIDIZING AGENTS**--Wear rubber gloves, face shield, lab coat. Use self-contained breathing apparatus for bromine and chlorine. Gas Leak--If the valve is leaking the gas can be neutralized by passing through a reducer like sodium sulfite and excess sodium bicarbonate solution. (Include a trap in the line to prevent the solution from being sucked back into the cylinder.) If the leak is in the valve assembly, cover with a plastic bag and remove to a hood to bleed off. Solutions or Solids--Cover with a reducer, (sodium thiosulfate (hypo), a bisulfite or a ferrous salt but not carbon, sulfur or strong reducing agents). Mix well and spray with water and some 3M-sulfuric acid to promote rapid reduction. Scoop slurry into a beaker of water and neutralize with sodium carbonate (soda ash) and wash down drain.

12B **REDUCING AGENTS**--Wear gloves, safety glasses, lab coat. Work in hood or use respirator. Gas Leak--Gas can be bubbled through calcium hypochlorite solution to neutralize. (Include trap.) Solid--Cover with sodium carbonate or sodium bicarbonate. Mix and spray with water. Wait till reaction is complete. Scoop into beaker and cautiously add an equal volume of calcium hypochlorite (reaction may be vigorous). Add more water. Wait one hour. Test with litmus. Neutralize with 6m HCl or 6m NaOH as required. Wash down drain with excess water.

13 **MERCAPTINS AND ORGANIC SULFIDES**--Wear rubber gloves, self-contained breathing apparatus, lab coat. Eliminate sources of ignition. Cover with 20% solution of calcium hypochlorite or household bleach. Scoop into beaker. After 12 hours neutralize as needed (6m HCl or 6M NaOH) and flush down drain.

14 **CYANIDES AND NITRITES**--Wear long rubber gloves, self-contained breathing apparatus, laboratory apron or coat. Evacuate the laboratory and isolate the area during decontamination.

Spills--Eliminate all sources of ignition and flammables.

General treatment:--Absorb liquid with vermiculite or on paper towel (sweep solid onto paper). Place on an iron or glass dish in a hood. Evaporate and burn paper. On skin--wash away immediately with much soap and water.

Hydrocyanic acid (HCN) leak: Turn on fume hood. Allow gas to leak into a container of sodium hydroxide solution while stopping leak. Add excess calcium hypochlorite to the alkali cyanide. Discharge the cyanate into the drain with excess water.

Cyanides:--Scoop into a larger beaker and make alkaline with sodium hydroxide solution. Add to the slurry an excess of ferrous sulfate solution. After one hour, flush down the drain with excess water OR Add excess sulfur to the alkaline slurry of the cyanide. Heat to convert to thiocyanate. Flush down drain with excess water.

Nitriles:--Add excess of strong sodium hydroxide and calcium hypochlorite solution to produce a cyanate. Scoop slurry into a large beaker. After one hour flush down the drain with excess water. Wash site with soap solution containing some hypochlorite.

15 ETHERS (NOTE: The shelflife of ethers is one year. Older ethers can form explosive peroxides. Treat older ethers as potentially explosive and contact the Division of Environment, Topeka, KS. for removal.)

Wear rubber gloves, face shield and self-contained breathing apparatus. Eliminate all sources of ignition. Absorb on paper towels and evaporate in the hood. Burn towels only after all fumes have been allowed to escape.

16 HYDRAZINES--Wear gloves, and self-contained breathing apparatus. Remove contaminated clothing at once and wash skin. Absorb on paper towels and take outside to incinerate.

17 HYDRIDES--Wear gloves and fire-proof clothing. Keep powdered graphite or dolomite for fire fighting. Eliminate sources of ignition. Scoop into plastic bag that has been purged with inert gas. Remove to outside for burning. Flood the burned residue with water to insure complete destruction of hydrides.

18 HYDROCARBONS, ALCOHOLS, KETONES, ESTERS--Wear gloves, face shield, lab coat. Gas Leak--Keep concentration low by forced ventilation. Remove tank to outside immediately. Liquid--Absorb on paper. Evaporate in hood. Cover with wire screen and burn paper. Solid --Sweep onto paper and place in iron pan in hood to burn.

19 INORGANIC AMIDES--Wear rubber gloves, face shield, lab coat. Sweep onto dry paper. Cautiously add water. Agitate. Neutralize. (3m HCl or 6m NaOG)

20 ORGANIC AMIDES--Wear rubber gloves, goggles, lab coat. Scoop into a paper bag. Take outside, add alcohol and burn.

21 **INTER NON-METALLIC COMPOUNDS**--Wear gloves, self-contained breathing apparatus, goggles. Eliminate all sources of ignition. Cover with vermiculite, sodium bicarbonate or 50-50 mixture of sodium carbonte and calcium hydroxide. Mix and spray water cautiously, (beware of flash fire). Scoop and sift cautiously into large volume of water. When reaction is complete, neutralize with 6m-HCl or 6m-NH_4OH as needed.

22A **INORGANIC PEROXIDES**--Wear rubber gloves, face shield, lab coat, Solid Peroxides--Cover with a double volume of sand and sodium carbonate. Mix, scoop and add to a beaker of sodium sulfite solution. Neutralize with dilute sulfuric acid. Decant liquid into drain; discard sand in plastic bag. Hydrogen Peroxide 3-90%--Dilute and wash down drain with excess water.

22B **ORGANIC PEROXIDES**--Wear rubber gloves, face shield, and lab coat. Caution--keep supplies low. Keep dry. Mix with vermiculite or sand. Remove outside. Ignite from a distance or call fire department.

23 **INORGANIC SULFIDES**--Wear gloves, goggles, self-contained breathing apparatus, lab coat. Eliminate all sources of ignition. Add ferric chloride solution ($FeCl_3$). Stir until FeS formation is complete. Add a slight excess of sodium carbonate. Scoop and wash down drain with excess water.

24A **ORGANIC ACIDS**--Wear gloves, goggles, lab coat, and self-contained breathing apparatus. Cover with sodium carbonate or bicarbonate. Mix and add water if necessary. Scoop and wash neutral waste down drain.

24B **INORGANIC ACIDS**--Same as 24A except a 50-50 mixture of calcium hydroxide and sodium carbonate may be used to cover.

25 **CARBIDES**--Wear gloves, goggles and lab coat. Keep dry initially. Cover with dry vermiculite, scoop into dry bucket. Transfer to open area. Remove all sources of ignition. Add material cautiously to a large volume of water. Allow to stand until any gas produced has been burned off. Pour down drain or take to land fill after 24 hours.

26 **WASTE FOR LAND FILL**--These may be dumped into land fills or released into air. See the previous section for the approved land fills.

27A **SCRAP METAL**--Return to land fill.

27B **MERCURY RECOVERY**--This metal should not be allowed to contaminate air or water. Wear glove, self-contained breathing apparatus, lab coat. Metal--collect all droplets and pools at once by means of suction pump and aspirator bottle with a long capillary tube. Cover fine droplets in non-accessible cracks with calcium polysulfide and excess sulfur. For very small quantities of material add zinc metal powder which will form an amalgum that can be disposed of as defined above. Combine all contaminated mercury in a tightly stoppered bottle. Hold it for purification or sale. Compounds--Dissolve all water soluble contaminated compounds. Convert other contaminated compounds to the soluble nitrates. Adjust the acidity and precipitate as mercuric sulfide. Wash and dry the precipitate. Ship to the supplier, or contact the Division of the Environment, Topeka, KS.

27C **PHOSPHORUS**--Wear gloves and face shield. Yellow--Cover with wet sand. Scoop into bucket of water. Let stand over night. Recover. OR If quantity is small, place in iron pan in hood. When dry it will ignite and burn off. Red--Sweep up. Burn in hood or iron pan.

27D **ARSENIC, ANTIMONY AND BISMUTH COMPOUNDS**--Wear gloves, goggles, lab coat, respirator. Work in hood. Dissolve in minimum 12M HCl. Dilute with water until white precipitate forms. Add 6 M HCl to redissolve. Saturate with hydrogen sulfide, filter and treat as disposal 11.

27F **LEAD AND CADMIUM SALTS**--Wear gloves, goggles and work in hood. Dissolve in a minimum of concentrated HNO_3. Evaporate in hood. Saturate with H_2S and treat as disposal 11.

27H **STRONTIUM AND BARIUM COMPOUNDS**--Wear gloves, glasses and coat. Dissolve in 6 M HCl. Filter. Neutralize filtrate with 6N NH OH and precipitate with excess sodium carbonate. Treat as disposal 11.

27J **HALOGENATED SOLVENTS**--Wear gloves, self-contained respirator (or work in hood), lab coat. Absorb on paper towels and evaporate in the fume hood. Cover paper with a wire screen. Burn paper.

TABLE OF HAZARDOUS CHEMICALS

Absence of an entry in any column does not necessarily imply that no information exists.

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Substance	Hazard Code				Personal Protection	Antidote	Extinguishing	Disposal		Incompatability	Remarks
	H	F	R	O				Sm.Qty.	Spills		
Acenaphthene		1			A			W	18	Oxidizing materials.	Irritant to skin and mucous membrane.
Acetaldehyde	2	4	2		A-B	W	2	E	2	Forms peroxide in air, sodium hydroxide, halogens, alcohols.	
Acetamide	1	0	1		A	W		S	20		Mild irritant.
Acetanilide					A-B	S	3	S	20	Oxidizing agents.	Avoid skin contact.
Acetic Anhydride	2	2	1		A-B	W	2	S	24a		Bubbles and gives off acetic acid vapors when mixed with water.
Acetic Acid	2	2	1		A-B	S	3	W	24a	Oxidizing materials especially nitric acid, sodium peroxide, chromic acid.	

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Acetone	1	3			A-B	W	2	W	18	Chloroform, Nitric acid, Hydrogen peroxide, Acetic acid, Sulfuric acid, Potassium dichromate.	
Acetyl Chloride	3	3	2		A-B	W	4	S	1a	Water, Ethyl alcohol.	Vapors heavier than air; may travel long distances along floor to source of ignition.
Adypl Chloride	1	1			A		4			Oxidizing agent.	
Alcohol (denatured) see Ethyl alcohol											
Aluminum Powder		1	1		A-B		5		27a		Separate from acids, caustics and chlorinated hydrocarbons. Keep from oxidizing materials. Highly explosive in air.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Aluminum Chloride	3		2		A-B	W		W	1 b		Violent reaction will result if streams of water hit large quantities.
Amber Oil	3	2			A-B-C	W	3		18	Heat, emits acrid fumes.	Composition, phenols, and terpenes.
Amines-(see Butyl Amine)								S	7b		
Ammonia	3	1			A-B-C	W	1	W	10	Ethylene dichloride Oxidizing agents.	
Ammonium chloride	2					W	6	W	11		In fire conditions wear goggles and self-contained breathing apparatus.
Ammonium Dichromates	1	1	1		A-B-C	W	6	W	11	Reducing agents Heat.	Explodes at 200°C.
Ammonium Fluoride	3					W	6	W	11		A respiratory and eye irritant.
Ammonium Hydroxide	2	1			A-B	W	6	W	10		

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Ammonium Molybdate					A-B-C	W					
Ammonium Permanganate	1		3		A	W	6	W	12a		Powerful oxidizing agent.
Ammonium Persulfate	1	2				W		S	12a	Na_2 O_2 powder Al, H2, reducing agents.	Heat can react vigorously with reducing agents. Powerful oxidizer.
Ammonium Sulfate					A-B	W	1	W	11	Potassium and ammonium nitrate, potassium chlorate with fire.	
Ammonium Thiocyanate					A-B	W		W	11	Lead Nitrate Pb $(NO_3)2$ acid fumes.	
ISO-Anyl Acetate	1	3			A-B	S	3		18	Reducing agents.	Moderate irritant via inhalation routes.
Amyl Alcohol (or ISO Amyl alcohol)	1	3			A-B	S	2	E	18	Oxidizing materials.	

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	Spills	INCOMPATABILITY	REMARKS
Aniline	3	2			A-B-C	S	2	S	5	Nitric Acid	Wash immediately, remove contaminated clothing at once and wash with strong soap.
Aniline Rye, Blue Black					A- C	S		S	5		Carcinogenic, decomposes with heat.
Aniline hydrochloride	3	1			A-B	S	3	S	5	Acids, Acid fumes, oxidizing materials, heat.	
Antimony	3	2			A-B	W	6	S	27d	Do not heat.	Sublimes when heated directly, vapors poisonous-use hood.
Antimony Chlorides (tri and penta)	3				A-B-C	W	6	S	27d	Reacts with H_2O to form toxic fumes.	Deliquescent
Antimony Pentasulfide	3	1	1		A-B-C	S	1	S	27d	Oxidizing materials, strong acids.	Moderate explosion hazard when shocked.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Antimony Sulfide								S	27d		See Antimony Pentasulfide, Antimony Trisulfide.
Arsenic	3	2			B-C	S		S	27d	Heat	Sublimes when heated-Arsenic vapors very poisonous, use hood, gloves, or tongs to handle.
Arsenic Acid	3				A-B-C	W		S	27d	Heat, acid, acid fumes, oxidizing materials.	
Arsenic chloride (tri)	3				A-B-C	O	3	S	27d	H_2O	Decomposes in water, soluble in Alcohol. On physical contact, rinse with alcohol.
Arsenic Pentoxide	3				A-B	S		S	27d		Carcenogen

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Arsenic trioxide	3				A-B	S		S	27d	Chlorine trifluoride, Fluorine, Mercury, sodium chlorate.	Carcenogen
Antimony trisulfide	3				A-B	S		S	27d	Oxidizing materials, heat, acid, acid fumes, water.	
Asbestos Pad											Do not heat, releases asbestos fibers. Remove from labs.
Ascarite (see Sodium hydroxide and asbestos)											See sodium hydroxide and asbestos.
Barium Peroxide	1				A	W	3	S	27h	Combustible organic of readily oxidizable materials, are explosive and easily ignited.	Avoid breathing dust.
Benzaldehyde	2	2			A-B	W	3	S	2		Dissolve in alcohol to discard small volumes.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Benzene	2	3			A-B-C	O or S	2	B	18		Cumulative poison, absorbed through skin or inhaled. Use in hood only, or with respirator. Wash with alcohol or acetone followed by soap and water. Remove contaminated clothing.
Benzoyl Peroxide	1	4	4		A-B	S	1	S	22b	Water	Reacts violently with water, suspend in diethyl phthlate for safe storage.
Bismuth	2							S	27d	Oxidizing agents, acid fumes.	

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	Spills	INCOMPATABILITY	REMARKS
Bismuth Nitrate	2				A	W		S	27d		
Bismuth Oxychloride	2				A-C	S		S	27d		
Bismuth Trichloride	2				A-C	S		S	27d	Na, K.	
Bromine	4		1		A-B-C	S	1	S	12a		Extremely toxic-use hood only, store separately.
Bromo Butane	2	3			A	S	2	S	4b	Heat, oxidizing materials.	
Brucine Sulfate	3				A-B	S		S	6	Heat	
N-Butyl Acetate iso-Butyl Acetate	1	3			A-B	S	2	S	18	Oxidizing materials.	Avoid prolonged contact with skin.
Butyl Acetate	1	3			B	S	2	E	18	Heat, flame, Oxidizing materials.	

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	Spills	INCOMPATABILITY	REMARKS
Butyl Alcohol (normal, secondary and tertiary)		3			A-B	W	2	W	18	Hydrogen peroxide	
N-Butyl Amine	3	3			A-B-C	S	3	W	7a		Inside storage, should be in a standard flammable liquid storage room or cabinet.
N-Butyl Bromide	2	3			A	S	2	S	4b	Oxidizing materials.	
Butyric Acid	2	2			A-B-C	S	3	S	24a	Oxidizing Agents.	Leaves obnoxious odor on hands or in air. Washing with brine or denatured alcohol helps.
Butyraldehyde	2	3	1		A-B	W	4	E	2		Separate from oxidizing materials and store flammable liquids storage cabinet.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Calcium	1	1	2		A-B-C		5	S	3		Do not handle with wet hands. Store under kerosene.
Calcium Carbide	1	4	2		A-B-C		5	S	25	H_2O	Do not handle with wet hands.
Calcium Chlorate	2	2			B	W	3	W	12a	Organic or other easily oxidizing materials.	
Calcium Cyanide	3				A-B-C					Keep dry and away from acid.	See EPA publication, Disposal of Hazardous waste.
Calcium Hydroxide (calcium oxide-Quicklime)	2				A-B	S	5	W or S	10		Not combustible but contact with H_2O may generate sufficient heat to ignite combustible materials.
Calcium Hypochlorite (bleaching powder)	2	1	2		A-B	W	6	S	12a		Decomposes in H_2O. Use in well ventilated area.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Carbolic Acid (see Phenol)	3	2			A-B-C	W	3	S	18	Butadiene, Calcium hypochlorite.	Causes severe tissue burns, may be absorbed through skin.
Carbon disulfide	2	3			A-B-C	W	4	S	9		Absorbed through skin, wash immediately. Reacts with light.
Carbon Monoxide	2	4			B	Fresh air	3	S	27j		Absorbed through skin, wash with alcohol, followed by soap and water.
Chlorine	3		1		A-B-C	W	1	S	12a		Toxic gas
Chloracetic Acid	4	2			A-B-C	W		S	4c		
Chloroform	3	1			A-B-C	Fresh air	3	S	27j		In high concentration may cause narcosis and death.

ABSENCE OF AN ENTRY IN ANY COLUMN DOES NOT NECESSARILY IMPLY THAT NO INFORMATION EXISTS.

SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	Spills	INCOMPATABILITY	REMARKS
Chromic Acid	1		1		A-B-C	W	6	S	12a	Acetic Acid, Alcohol.	Powerful oxidizing material.
Chromium Chloride (chromic)					A- C	W		S	11		Do not heat.
Chromium trioxide (chromic acid)	3		1		A	W	1	S	12a	Acetic acid, alcohol, organic materials.	Do not store on wood floors. Keep dry.
Clove Oil (chief known constituent Eugenol)											
Cobalt Nitrate	1		1			W		W	11		
Cobalt Metal	2							S	27a		
Cupric Nitrate (see nitrates)	1						3	W	11	Oxidizing materials.	Separate from combustible, organic or other readily oxidizable materials.
Cyclohexane	1	3					4	E or B	18		Flammable
Cyclohexanone	1	2					3	E or B	18		
Cyclohexene	1	3					4	E or B	18		Flammable

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Dichloro Benzene (ortho)	2	2			A-B-C	W	3	S	6		Wash off skin immediately with soap and water. Remove contaminated clothing.
Dichloro Benzene (para)	2	2						S	6		Sublimes-Keep tightly covered.
Dichloro ethane (ethylene dichloride)	2	3			A-B-C	W	2	E	4b		Flammable-not soluble in water.
Dichloro methane (see methylene dichloride)	2	1			A-B	W	1	E	26		Flammable vapor-air mixtures at approx. 212°F., or higher.
Dichromates (all except Ammonium-See Ammonium dichomate for special data)	1		1		A-B-C	W	6	W	12a		
Diethyl phthalate		1					3	E	18		

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Dimethyl sulfoxide DMSO	1	1			A- C	S	3	E	4b	Oxidizing materials.	Do not heat.
2,4 dinitrophenyl hydrazine	3	3								Direct heat.	Dangerous explosive. Always dissolve before heating.
1, 4-dioxane	2	3	1		A-B	W	2	S	18	Hydrogen, nickel	Tends to form explosive peroxides.
Diphenylamine	3	1			A-B-C	W	3	S	5	Oxidizing materials, heat.	
Ether (diethyl)	2	4	1		A-B-C	Fresh air	2	E or S	15		Flammable liquid storage. Isolate from other combustible materials.
Ethyl Acetate	1	3			A-B-C		2	E or W	18		Flammable
Ethyl Alcohol		3			A-B	W	2	W	18	Peroxides, Nitrates, Sodium Silver nitrate.	
Ethylene glycol	1	1			A-B-C		3	W	18		

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Ethyl Methyl Ketone MEK	1	3			A-B-C		2	W	18		Flammable
Formaldehyde	2	3			A-B-C	W	3	W or S	2		
Formic Acid	3	2			A-B-C	W	4	S	24a	Hydrogen peroxide.	
Furfural	2	2	1		A-B	S	3	S	2	Oxidizing materials, strong acids.	Avoid contact and inhalation of any concentrations of vapors.
Gallic Acid (3,4,5,-trihydroxy benzoic acid)	1		1		A	S		A	24a	Potassium Chlorate, Nitrates, Permanganates, Ferric salts.	Oxidizing agents.
Gasoline (see hydro carbons)	3						2	E or S	18		Flammable
Glycerol (glycerine)	1	1			A-B-C		3	W	18		
Hexane (see hydrocarbons)									Spills		

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Hexyl Diamine	2	3			A-B	S	2	S	7a		
Hydrocarbons		3					2	E or S	18		Flammable
Hydrobromic Acid	3				A-B-C	W	3	W	24b		On skin neutralize with sodium bicarbonate, soda ash or slaked lime.
Hydrochloric Acid	3				A-B	S		W	24b		Vapors very toxic-Always use hood.
Hydrofluoric Acid	4				A-B-C	S	6	S	24b	Arsenic Trioxide, Phosphorus. Pentoxide.	Highly toxic and irritating to eyes, skin or respiratory tract.
Hydrogen		4			A		1	E	26		Highly flammable and explosive.
Hydrogen Cyanide	4	4	2		A-B-C	W	2	S	14		Absorbed through skin. Always wear gloves and full protective clothing.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Hydrolodic Acid	3				A-B-C	W		W	24b		On skin neutralize with sodium becarbonate, soda ash, or slaked lime.
Hydrogen Peroxide (3-50%)	2		1		A-B-C	W	6	W	22a	With readily oxidized materials.	Powerful oxidizing material.
Hydrogen Sulfide	3	4			A-B	W/P	1	S	23		Highly toxic and highly flammable.
Iodic Acid	3	2			A-B-C	W		W	24b	Flammable, combustible materials, reducing materials.	
Iodine	3				A- C			S	12a		Clean stains on floor and hands with a solution of sodium thiosulfate.
Isopropanal	2	4	2		A	W	2	E	2	Oxidizing materials.	
Isopropyl Alcohol	1	3			A-B-C		2	W	18		Flammable

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Kerosene (see hydrocarbons)									Spills		
Lead Nitrate	1		1			W	3	W	27f		Decomposes at 410° F, releasing toxic nitrogen oxides. Store separately from organic or oxidizing material.
Lead Peroxide	3	2	2		A	S		S	27f	Reducing agents, HCl.	Heating releases O_2. Avoid breathing.
Lithium	1	1	2		A-B		5	S	3	Chlorinated Hydrocarbons.	
Lithium Hydroxide (see sodium hydroxide)											
Lucus Reagent (see Hydrochloric acid)	3				A-B-C	W	3	W	Spills	Separate from all oxidizing metals.	Avoid inhaling fumes.
Lye (see Sodium Hydroxide)											

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Magnesium		1	2				5		Spills (recover)	Phosphates, chloride, cyanides, sulfates.	If burned, shield eyes with cobalt glass.
Magnesium Nitrate (see nitrates)	1		1		A-B-C		3	W	11	Halogens, oxidizing agents and acids.	Avoid inhaling dust. Protect from moisture and sources of ignition.
Malathion	3				A-B-C			S	7b		Absorbed through the skin. Wash with alcohol followed by soap and water.
Mercury	3				A-C	0		S	27b	Acetylene, Chloine, Ammonia, Carbide.	Extremely toxic, absorbed through skin, cumulative poison. If gotten on skin sprinkle with zinc dust, brush off, and wash.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Mercury Oxide	3				A-C	S		S	27b	Hydrogen Peroxide, Potassium sodium, Sulfur, Hydrogen sulfide.	Extremely toxic, absorbed through the skin, cumulative poison. Heating releases oxygen gas and toxic mercury vapors.
Mercuric Salts	3				A-C	S		S	27b	Acetylene	Extremely toxic, absorbed through the skin, avoid contact. Cumulative poison.
Methyl Acetate	1	3	1		A-B	S	2	E or S	18	Lithium Aluminum Hydride	
Methyl Alcohol		3			A-B	W	2	W	18	Sodium Hydroxide and Chloroform.	
Methyl Chloride	2	4			A-B	S	3/1	E	4b	Metals	Store in dry, cool area away from fire hazards. Avoid coming in contact with vapor.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Methyl Ethyl Ketone, (MEK) (see Ethyl methyl Ketone)									Spills		
Methyl Methacrylate (monomer)	2	3	2		A-B	S	2	E	18	Oxidizing materials.	Store in flammable storage cabinet.
Methyl Salicylate	1	1			A	S	4	S or W	18		
Mineral Spirits	1	3			B	S	1/2	E	18		Very volatile and vapors extremely volatile. Use in hood. Extinguish all sources of ignition.
Monochloroacetic Acid	4	2			A-B-C	W or S	2	S or W	4c	Oxidizing agents, Nitric acid, Sodium peroxide, Chromic acid.	Heating releases phosgene, and chlorides, skin irritant.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Monochloro Benzene	2	3			A-B	S	2	E	4b	Separate from oxidizing materials.	Outside storage preferable; store inside in flammable liquids storage cabinet.
Muriatic Acid (see Hydrochloric acid)											
Naphtha (see petroleum ether)											
Naphthalene	2	2			A-B	S	3	E or S	18	Oxidizing materials, chromic anhydride.	Vapor extremely flammable-heat with extreme care.
D-Naphthol 1-Naphthol	2	1			A-B			S	18		Avoid contact with skin.
B-Naphthol 2-Naphthol	2	1			A-B	S	2	S	18		
Nickel Nitrate (see nitrates)	1							W	11		

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Nickel Catalyst (powder)		2			B		6	S	27a	Strong acids and caustics oxidizing materials.	Dust is highly combustible; nickel ignites spontaneously in air. Store heavy nickel in water or under inert gas. Keep dry.
Nicotine	4	1			A-B		2	W	5	Heat, oxidizing materials.	Avoid contact with skin.
Nitric Acid	2		1		A-B-C			W or S	24b	Metal powders, carbides hydrogen sulfide, turpentine, acetic acid.	Strong oxidizing agent.
Nitrogen Tetroxide	3		1		A-B-C	P		E or S	21	Combustible, organic or other oxidizable materials; water; fuels and chlorinated hydrocarbons.	Extremely corrosive when wet, vapors extremely toxic. May cause fatal lung damage in dilute concentrations. May cause severe eye and skin burns.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Octane (see hydrocarbons)											
Octyl Alcohol	1	2				S	1,2	W	18		
Oleic Acid		1			A	S	4	S	24a		
Oxalic Acid	2		1		A-B	W	3	W or S	24b	Cu, silver compounds, sodium chlorite.	Use in hood.
Oxygen	3							E	26	Avoid sparks, oil and grease, flames, etc.	Explosion hazard.
Paraformaldehyde	2	2	2		A-B		3	W or S	2	Combustibles, and acidic, alkaline and oxidizing materials.	
Parathion	4	1			A-B-C	P/O	3	S	7b		Absorbed through the skin. Wash with alcohol-water is ineffective.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Pentane (see petroleum ether)											
Pentene	1	4			A-B	S	2	E or B	18	Oxidizing agents.	
Perchloric Acid	3		3		A-B-C	W		S	12a	Sodium Iodine	May form explosive mixtures with organic materials.
Petroleum Ether	1	4			B	S	2	E	18		Check labels-may contain Benzene.
Phenol	3	2			A-B-C	S	3	S	18	Chlorides, nitrates, Butadiene	Absorbed through the skin-very toxic. Wash with soap and water.
Phosphorous (yellow)	4	4	1		A-B-C	P (keep wet)	3	S	24c	Air, Potassium chlorite, sulphur, iodine, turpentine.	Keep under water.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Phosphorous (red)		1	1		A	W	3	W	27c	Oxidizing agents (hydrogen peroxide, chlorates, etc.)	Fumes from burning phosphorus highly irritating.
Phosphoric Acid	2				A-B	W		W	24b		
Phthalic Anhydride	2	1			A-B	S	4	S	24a		Dust and vapors hazardous.
Picric Acid	2	4	4		A-B-C			W	6		Call for assistance immediately if found. Do not handle. Explodes violently. Extremely dangerous if dry. Keep wet.
Potassium	3	1	2		A-B-C	P (brush or keep wet)	5	S	3	H_2O	Explosive on contact with H_2O (releases hydrogen.) Store under kerosene.
Potassium Chromate	3				A	W		W	12a	Reducing agents.	

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Potassium Cyanide	3				A-B-C	W/P	W	S	14	Acids, oxidizing materials, chlorates, nitrites, nitrogen trichloride.	Extremely toxic; releases highly toxic hydrogen cyanide gas rapidly on contact with acids.
										(See EPA publication on disposal of small batches of hazardous waste.)	
Potassium Dichromate	3				A-B	S	W	W	12a	Combustible, organic or readily oxidizable materials; acetone, H_2SO4, hydroxylamine.	Decomposes under heat to form oxygen.
Potassium Hydroxide	3				A-B-C	W	W	W	10	Separate from acids, metals, explosives, organic peroxides, easily ignitible materials.	Severe eye hazard; solid or concentrated solution destroys tissue on contact.
Potassium Nitrate (see nitrates)	1		1		A			W	11		

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Potassium Permanganate			1		A-B	S	W	W	12a	Separate from H_2SO4, H_2O_2 and all combustible, organic or readily oxidizable materials.	Explosive in contact with sulfuric acid or hydrogen peroxide; increases flammability of combustible materials.
Potassium Peroxide	3		2		A-B-C	W	5	S	22a		Powerful oxidizing material. Keep dry-reacts vigorously with water.
Potassium Persulfate	1		1		A-B		W	W	12a	Combustibles, organic or other readily oxidizable materials.	
Potassium Sulfide	3		2		A-B	S	6	W	23	Separate from acids, oxidizing materials and sources of ignition.	Yields highly toxic hydrogen sulfide on contact with acids and toxic sulfur dioxide when burning.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Propyl Alcohol	1	3			A-B	W	2	W	18		
Pyridine	2	3			A-B	S	2	W	5	Oxidizing materials.	Store in flammable liquids storage cabinet. Avoid inhaling.
Pyrogallic Acid (1,2,3 trihydroxy benzene)	3	1			A-B-C	W		W	24a	Oxidizing agents.	May be absorbed through skin.
Quinine	2				A			W	18		Avoid prolonged contact with skin.
Resorcinol	2	1	2		A-B-C			W	18	Acetanilide, albumin alkalies, ferric salts.	
Silver Nitrate (see nitrates)	1		1					S	27k		Causes discoloration on hands.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Sodium	3	1	2		A-C	Brush or use sand	5	S	3	Halogens, phosphorous	Keep away from water. Store under nitrogen or kerosene.
Sodium arsenate (dibasic $7H_2O$)					A-B	S		S	27d	Keep dry.	Poisonous
Sodium Arsenite					A-B	S		S	27d	Keep dry.	Poisonous
Sodium Azide	3	2	2		A-B-C				8		Very unstable.
Sodium Bismuthate	2	2	2		A-B			W	12a	Liberates chlorine gas with HCl.	
Sodium chlorate (see potassium chlorate)	1		2					W	12a		Heating gives slow release of oxygen.
Sodium Dichromate (see Potassium dichromate)											

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Sodium Cyanide	3				A-B-C	S	6	S	14	Acids and oxidizing materials. Separate from other storage.	Dispose! See EPA publication, Disposal of Small Batches of Hazardous Wastes. Very Toxic.
Sodium Fluoride	3				A-B	S	6	W	11	Store away from acids or alkalies.	Avoid breathing or coming in contact with dust.
Sodium Hydroxide	3		1		A-C	W	6	W	10	Acetaldehyde	Keep dry; severe eye hazard-solid or concentrated solution destroys tissue on contact. Reacts with water liberating heat. Do not store in glass.
Sodium Hypophosphite								W	11	Chlorates and other oxidizing agents.	

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Sodium Hyposulfate								W	11	Oxidizing agents, particularly chlorates.	See Sodium bisulfate.
Sodium Nitrate (see nitrates)	1		2					W	11		
Sodium Peroxide	3		2		A-B-C	S	5	S	22a	Combustible, organic or readily oxidizable substances.	Explosive, ignites easily on contact with a small amount of H_2O or by friction.
Sodium Persulfate (sodium peroxy disulfate)						W					Bleaching and oxidizing agent. Avoid contact with skin.
Sodium Sulfide	2	1			A-B	S	6	S	23	Separate from acids, oxidizing materials and possible sources of ignition.	Toxic-yields hydrogen sulfide on contact with acids and toxic sulfur dioxide when burning.

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Sodium Thiosulfate	1				A	S		W	12b	Sodium nitrite	
Strontium Nitrate (see nitrates)	1		1					W	27h		
Styrene (monomer)	2	3	2		A-B-C	O	3		18	Oxidizing materials.	Phenyl ethylene. Store in metal storage cabinet. Polymerization may cause violent rupture of container. Wash off skin with alcohol then use soap and water.
Sulfur	2	1			A	S	3	S	26	Oxidizing materials; chlorates, nitrates.	Easily ignitable solid; dust forms explosive mixtures with air.

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SUBSTANCE	HAZARD CODE H	F	R	O	PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL Sm.Qty.	-Spills	INCOMPATABILITY	REMARKS
Sulfur Dioxide	3				A-B	Fresh air/W	1	S	12b		Avoid inhaling, protect eyes.
Sulfuric Acid	3		2		A-B-C	S		W or S	24b		Add to large volumes of water carefully-releases large amounts of heat.
Sulfurous Acid	3		2		A-B	S		W	24b		Add to water carefully, releases large amounts of heat.
Tetrachloroethylene (perchloroethylene)	3				A-B	S	3	E	27j		Use in well ventilated area only.
Tetrafluoroethylene	3				B		2	F	27j	Separate from oxidizing materials, iodine pentafluoride and limonene.	
Trichloroacetic Acid	3				A-B	W		W	4c	Heating with caustic alkalies.	

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SUBSTANCE	HAZARD CODE				PERSONAL PROTECTION	ANTIDOTE	EXTINGUISHING	DISPOSAL		INCOMPATABILITY	REMARKS
	H	F	R	O				Sm.Qty.	Spills		
Toluene	2	3			A-B-C	S	2	E	18	Separate from oxidizing materials, nitric acid and sulfuric acid.	Cumulative poison, absorbed through skin.
Vinyl Chloride	2	4	2		B	S		E	4b	Separate from oxidizing materials; do not expose to air.	Acts as general anesthetic; forms explosive mixtures with air.
Xylene	2	3			B	S	2	E	18	Separate from oxidizing materials.	Avoid inhaling vapors; store in flammable liquids storage cabinet.
Zinc Powder					B	S	5	S	27a	Separate from acids, halogenated hydrocarbons and strong alkali hydroxides.	Avoid breathing dust.

REFERENCES

Materials were selected and reviewed from the following sources and in some instances were incorporated in the production of the preceding unit.

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6. *Manual of Hazardous Chemical Reactions*. Boston, MA: National Fire Protection, 1975
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PHOTO CHEMICALS

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PHOTO CHEMICALS

There are many different photo chemicals that exist in today's market. Continually photographers experiment with the different quality of chemicals to attain better results. Basically, these varied brand names contain the same elements but are composed in different proportions. Therefore, in this section it is only necessary to group them according to their basic content and use--not brand names. Precautions are written in respect to these basic chemical contents.

INFORMATION PROFILE--PHOTOGRAPHIC PROCESSING

MATERIAL	COMPONENTS	CHEMICAL COMPOUNDS	PRECAUTIONS AND EFFECTS
Black and white film developer	Reducers	P-Methylaminophenol (elon, pietol, metol, rhodol)	May cause skin irritation.
		P-Dihydroxybenzene (hydroquinone, quinol)	May cause eye injuries which develop over a period of years. Absorbed through mucous membrane or skin and could cause shock, kidney irritation, or death.
		O-Dihydroxybenzene (Resorcinol, pyrocatechin. catechol)	Contact with skin causes convulsions. Death may be initiated by respiratory failure when resorcinol is heated. It is highly toxic, produces rise in blood pressure.
		P-Hydroxyphenylaminoacetic acid	Use normal precautions for handling chemicals.
		I-Phenyl-3-pyrazolidone	Use normal precautions for handling chemicals.
		P-Aminophenol	May cause skin sensitization, dermatitis. Inhalation can cause asthma, methemoglobin formation.

MATERIAL	COMPONENTS	CHEMICAL COMPOUNDS	PRECAUTIONS AND EFFECTS
Black and white film developer	Accelerators	Sodium carbonate	Non-hazardous
		Borax	Non-hazardous
		Potassium-carbonate	Causes skin irritation, kidney failure and severe stupor.
		Sodium teraborate	Use normal precautions for handling chemicals.
		Sodium hydroxine	Caustic to skin. Avoid breathing dust. If it comes in contact with skin, flush skin with water
	Restrainers, anti-foggants	Benzotriazole	Moderate toxicity. Use normal precautions for handling chemicals.
		6-nitrobenzimidazole nitrate	No data
		Potassium bromide	Use normal precautions for handling chemicals.
		Sodium bromide	Use normal precaution for handling chemicals.
	Preservatives, PH Adjusters	Sodium bisulfite	Skin irritation, sulfur-dioxide odor
		Potassium metabisulfite	Sulfur dioxide odor. Keep dry and well closed. Mild skin irritation. Use normal precautions for handling chemicals.

MATERIAL	COMPONENTS	CHEMICAL COMPOUNDS	PRECAUTIONS AND EFFECTS
Fixation	Fixing agent	Sodium thiosulfate (hypo)	Use normal precautions when handling this chemical.
	Hardners, ph-adjusters preservatives	Sulfuric acid (concentrated)	When added to water, much heat is generated! When diluting, the acid should be added to the water. Handle with caution avoiding contact with the skin, as it produces severe burns (flush with water).
	Hardner in fixer	Potassium aluminum sulfate (abun)	Use normal precautions when handling this chemical.
		Sodium aluminum sulfate (alum.)	Use normal precautions when handling this chemical.
		Acetic acid	Caustic; skin, eye, and lung irritation.
Color Developer	Contrast control agents (in developer)	Citrazinic acid	Use normal precautions for handling chemicals.
		Ethylenediaminetetraacetic acid	Use normal precautions for handling chemicals.

MATERIAL	COMPONENTS	CHEMICAL COMPOUNDS	PRECAUTIONS AND EFFECTS
Color developer (con't.)	Bleaching agents	Potassium ferricyanide/ potassium bromide mixture	Low toxicity, only local irritation. Highly toxic fumes, if heated. Cyanides--long exposure may cause loss of appetite, headache, weakness, nausea, dizziness, and symptoms of upper respiratory tract and eye irritation.
	Color-fog restrainer	Hydroxylamine hydrochloride	Acute exposure causes moderate gastrointestinal and respiratory irritation. Continuous exposure may cause methemoglobinemia.
	Dye-couplers developing	Diethyl-P-phenylenediamine	Compound may produce eczemotoid, contact dermatitis, bronchial asthma.
		4-amino-N-ethyl-N-(B-methane-sulfonami-diethyl)-M-toluidene sesquisulfate monohydrate	Pure compound or intermediate products may produce eczemotoid, contact dermatitis, bronchial asthma.
		4-amino-3-methl-N-ethyl-N-(B-hydroxgethyl) aniline sulfate	Avoid inhalation, ingestion or absorption (not identified specifically but it is a derivative of aniline).
	Hardener, stabilizer	Formalin (40% formaldehyde)	Topical application may produce an irritant dermatitis, Vapors are intensely irritating to mucous membranes.

MATERIAL	COMPONENTS	CHEMICAL COMPOUNDS	PRECAUTIONS AND EFFECTS
Hypo eliminator	None	Ammonia	To acute exposure temporary olindness and severe eye damage. Above 2-25 ppm can cause severe irritation.
		Hydrogen peroxide (3% solution)	Keep protected from light and in a cool place--it is an oxidizer.
		Potassium permanganate	Diluted solutions are mildly irritating and high concentrations are caustic.
		Sodium hypochlorite	Inhalation may produce severe bronchial irritation, pulmonary edema. Prolonged skin contact may result in irritation.
		Iodine	Iodine vapors are irritating and corrosive. Inhalation of vapors cause epiphora, tightness in the chest, sore throat, and headache.
		Potassium perborate	Keep well closed in a cool place--use normal precautions when handling this chemical.
Silver Solvent		Potassium, thiocyanate	Human toxicity, may cause skin eruptism, psychasis (wear rubber gloves and aprons).

MATERIAL	COMPONENTS	CHEMICAL COMPOUNDS	PRECAUTIONS AND EFFECTS
Intensifiers	None	Mercuric chloride	Danger! May be fatal if swallowed. Do not breathe dust; wash hands before eating or smoking--highly toxic. Corrosive to mucous membranes.
		Mercuric iodide	Poisonous! Do not breathe dust, wash hands before eating or smoking, corrosive effect on skin and mucous membrane.
		Silver nitrate	Reacts with skin protein. Turns skin black; caustic and irritating to skin, mucous membranes.
		Potassium cyanide	Danger! Poison may occur by ingestion, absorption through injured skin, or inhalation of dust. FATAL
		Potassium bichromate	Industrial contact may result in loss of cells in the hands, destruction of numerous membranes.
		Hydrochloric acid (muriatic acid)	Contact with skin causes severe burns; inhalation of fumes causes severe coughing, choking. Inflammation of respiratory tract may occur. Use in well-ventilated room.
Intensive Preservative	PH adjuster	Sodium sulfite	Large doses of sodium sulfite cause retarded growth, nerve irritation, bone marrow atrophy, depression. Highly toxic if it is heated.

PHOTOGRAPHY (CHEMICALS) SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ______________ GRADE __________

True-False

T F 1. If you are engaged in any activity where corrosive chemicals exist, you must use goggles or eye shields.

T F 2. Always add the water to the acid solution, never the opposite.

T F 3. Chemicals and water that are spilled on the floor don't need to be wiped up until after class is over.

T F 4. Infection may result from uncared-for cuts and scratches.

T F 5. Chemicals should only be stored in dark brown plastic bottles which have been designated for photographic applications.

T F 6. When mixing chemicals, always wear safety glasses to protect your eyes, and an apron to protect your clothes.

T F 7. Special care need not be given to developers, sepia and selenium toners, and acetic acid.

T F 8. Plastic or rubber gloves will provide adequate protection to persons with allergic skin reactions to certain chemicals.

T F 9. Spilling chemicals on clothing may cause skin irritation.

T F 10. Many photographic chemicals are poisonous and/or caustic and should only be handled by the instructor.

T F 11. After using chemicals in the darkroom, wash hands carefully with soap and water.

T F 12. Label and handle all chemicals with care.

T F 13. Dangerous chemicals should be marked clearly and stored above eye level.

T F 14. Rubber gloves, aprons, and goggles need not be used when handling toxic chemicals.

T F 15. If you have used the chemical before, it is not necessary to read the instructions or safety precautions.

T F 16. Mix chemicals only in a room with adequate ventilation, preferable on exhaust fan.

T F 17. If in doubt, write to the manufacturer of the product for safety information.

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

Technical Report #548, Science Information Services Department.
Contact No. 210-77-0167, The Franklin Institute Research Laboratories
January, 1978

PRINTMAKING CHEMICALS

PRINTMAKING CHEMICALS

SOLVENTS

In general, solvents are one of the most underrated hazards in art. They are used for a million purposes: to dissolve and mix with oils, resins, varnishes, and inks; to remove paint, varnish, and lacquers; and to clean brushes, tools, silk screens, and even the hands. As a result, artists are continually being exposed to solvents.

Almost all organic solvents are poisonous if swallowed or inhaled in sufficient quantity, and most cause dermatitis after sufficient skin contact. High concentrations of most solvents can cause narcosis (dizziness, nausea, fatigue, loss of coordination, coma, etc.). This can increase the chances for mistakes and accidents. Some solvents--for example, benzol (benzene) and carbon tetracholoride--are so toxic that they shouldn't be used. Other solvents--for example, acetone and ethanol (ethyl or grain alcohol)--are reasonably safe.

Solvents fall into several classes with similar properties. If one member of a class of solvents is toxic, usually another safer member can be chosen.

ALCOHOLS are generally anesthetics and irritants of the eyes and upper respiratory tract. In high concentrations, methanol (wood or methyl alcohol) can cause dizziness, intoxication, blurred vision, and possible liver and kidney damage. If swallowed, it can cause blindness and even death. Ethanol, available as denatured alcohol containing some methanol, is a safer solvent. Amyl alcohol acts on the nervous system causing dizziness, nausea, vomiting, and double vision.
Uses: shellac thinner, paint and varnish remover, lacquer thinners, etc.

AROMATIC HYDROCARBONS are among the most dangerous of solvents. In general, they are narcotic and irritating to the skin. The most dangerous is benzol (benzene), which causes chronic poisoning from the cumulative effect of exposure to small amounts. It causes destruction of the bone marrow, leading to loss of red and white blood cells, and sometimes leukemia. Toluol (toluene) doesn't have the long term chronic effects of benzene, but its immediate effects can be more severe if a person is exposed to a high enough concentration. With proper ventilation, however, toluol is a suggested replacement for benzol. Xylol (xylene) is similar to toluol and may cause some chronic blood damage. Uses: resin solvent, paint and varnish remover, flourescent dye solvent, common silk screening wash-up, lacquer thinners, aerosol spray cans, etc.

SOLVENTS (continued)

CHLORINATED HYDROCARBONS, like aromatic hydrocarbons, are very hazardous. Some have been used as anesthetics in the past, but were found to be too toxic. All of them dissolve the fatty layer of the skin and can cause dermatitis. They also cause liver and kidney damage. The drinking of alcohol after exposure to chlorinated hydrocarbons can make people very sick. One of the most toxic chlorinated hydrocarbons is carbon tetrachloride, and it shouldn't be used. It can be absorbed through the skin, and exposure to small amounts can cause severe liver and kidney damage. Exposure to larger amounts can cause unconsciousness and death. Other toxic chlorinated hydrocarbons include: tetrachloroethane (acetylene tetrachloride), chloroform, ethylene dichloride, perchoroethylene, and trichloroethylene. The last four solvents have been shown to cause liver cancer in mice. Methyl chloroform (1,1,1-trichloroethane) appears to be less toxic than other chlorinated hydrocarbons, although it may cause heart problems. Methylene chloride (dichloromethane) is highly volatile, and high concentrations may cause narcosis, lung irritation, and pulmonary edema. Methylene chloride also decomposes in the body to form carbon monoxide, and inhalation of large amounts has resulted in fatal heart attacks. People with heart problems and smokers are particularly taking a high risk. Although most of the chlorinated hydrocarbons are not flammable, they may decompose in the presence of ultraviolet light or excess heat (e.g. a lighted cigarette) to form the poison gas phosgene. In general, the chlorinated hydrocarbons should be replaced with less toxic solvents. Uses: wax, oil resin, grease and plastics solvent, and paint strippers.

PETROLEUM DISTILLATES tend to be less toxic than most other solvents. They have a mild narcotic effect and can cause lung irritation in large amounts. If ingested, they may cause pulmonary edema and possible death, due to aspiration into the lungs. Petroleum distillates are also skin irritants. Hexane, one of the most volatile petroleum distillates, may cause peripheral neuritis--nerve inflammation and possible paralysis of arms and legs--from chronic inhalation of large amounts. Hexane is found in "extremely flammable" rubber cement thinners and in low-boiling naphtha (petroleum ether). Other petroleum distillates, in an increasing order of boiling point are: gasoline, benzine (VM&P Naptha), mineral spirits (odorless paint thinner, white spirits), and kerosene. Uses: paint thinners, rubber cement thinners, silk screen poster inks, clean up solvent, etc.

ETHERS are eye, nose, and throat irritants and have anesthetic effects. Most common acetates are not skin irritants or sensitizers. Ethyl acetate is the least toxic, followed by methyl and amyl acetates. Methyl cellosolve (ethylene glycol monomethyl ether acetate) is very toxic, causing anemia and other blood diseases. It is dangerous, both through inhalation and through skin contact. Methyl cellosolve is similar to the acetate. Cellosolve (ethylene glycol monoethyl ether) and cellosolve acetate are less toxic than the methyl counterparts. Uses: lacquer, resin, and plastic solvent.

KETONES cause narcosis and irritation to the eyes and upper respiratory tract when used in high concentrations. Their odor-warning properties are a good indication of the degree of exposure. They also cause defatting of the skin upon prolonged exposure, resulting in dry, scaly, cracked skin. Acetone is one of the safest solvents (except for its high flammability) and does not seem to have any lasting effect. Methyl ethyl ketone (MEK) is more toxic than acetone. Methyl butyl ketone may cause peripheral neuritis. In some cases, this has resulted in paralysis of the arms and legs. Uses: solvent for lacquers, oils, waxes, and plastics.

OTHER SOLVENTS include ethyl ether, a very volatile lacquer solvent and anesthetic, and turpentine. The latter is a very common oil paint and varnish thinner. Turpentine is a skin irritant and sensitizer for many people. Its vapors are irritating to the eyes, nose, and throat upon prolonged exposure. The resulting symptoms include headaches, gastritis, anxiety, and mental confusion. Turpentine is highly poisonous by ingestion, with one tablespoon being fatal to a child.

A few solvents are so hazardous that they should never be used. These are carbon tetrachloride, benzene or benzol, methyl butyl ketone, and methyl cellosolve.

AEROSOL SPRAYS

Artists are using a multitude of aerosol sprays today: fixatives, retouching sprays, paint sprays, varnishes, adhesive sprays, etc. Aerosol sprays are very dangerous unless used in such a way that a person does not breathe the vapors. The fine mists containing possible toxic substances (from paints, varnishes, adhesives, etc.) can travel long distances before settling. Further, they penetrate deep into the lungs. Along with the dangers from the substances dissolved in the sprays, the solvents are propellants which are often hazards, also.

For example, many sprays contain toluol and chlorinated hydrocarbons. In spray form, these solvents may be more dangerous than in vapor form because the mists contain larger quantities of solvent. Concern about propellants mounted when it was disclosed that many spray products contained vinyl chloride, a chemical that has been shown to cause liver cancer. These products have been withdrawn from the market. Many propellants and solvents used in aerosol cans are highly flammable.

AEROSOL SPRAYS (continued)

Air brushes and spray guns are also hazardous since they produce fine mists which can enter the lungs.

ACIDS AND ALKALIS

Acids cause burning of the skin, especially when concentrated. If acid is spilled on the skin, it should be washed with plenty of water. An important safety rule with acids is to add the acid to the water, not the other way around. Strong acids include: acetic, carbolic (phenol), chromic, hydrochloric, nitric, sulfuric, hydrofluoric, and perchloric. Chromic acid is also a skin sensitizer. The fumes from etching metals with nitric acid are very dangerous since they burn the lungs and may result in pulmonary edema (fluid in the lungs). Exposure to excessive nitric acid fumes can be fatal. Uses: cleaning metals, etching metals, and dyeing.

Alkalis cause burning of the skin and eyes, and ulcers. Potassium (caustic potash) and sodium hydroxide (caustic soda) are the most dangerous. Other alkalis that cause burns are sodium carbonate, potassium carbonate, calcium oxide (quick-lime or unslaked lime), calcium hydroxide (slaked lime), sodium metasilicate, sodium silicate, and ammonia. Ammonia vapors and quicklime dust can also damage the lungs.

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SAFETY DATA TABLES (REPRODUCED FROM HEALTH AND SAFETY IN PRINTMAKING)

The first column of the Tables lists the trade names or familiar names of the materials.

The second column contains information on the chemical content which has been obtained from manufacturers, suppliers, textbooks, and, in a few instances, by actual chemical analysis in the laboratory. The entries in the column are sometimes incomplete due to the manufacturer's request for confidentiality. For this reason general chemical groups are substituted for specific chemical names in some cases. However, the hazards and precautions are given for the total composition. It is thought that by supplying chemical compositions, the printmaker will understand the need for controls and will also be able to use the right type of glove, barrier cream, or respirator.

The third column shows the Alberta TLV (Threshold Limit Value) for the material and refers only to exposure by inhalation. A TLV is not always applicable as some materials do not give rise to an inhalation hazard, e.g. dilute solutions, viscous substances, or bulk solids.

The fourth column lists the hazards associated with the material. The symptoms shown should be expected ONLY WHEN THE TLV IS EXCEEDED OR WHEN THERE IS PHYSICAL CONTACT RESULTING IN SKIN ABSORPTION AND IRRITATION.

The final column gives the precautions to be taken to minimize exposure to the material.

TOXICITY RATING--A toxicity rating, based on the effects of chemicals on humans, has been given to each material whenever possible. The ratings are as follows:

TOXICITY RATING	RESPONSE	EXPOSURE LIMITS
1	Relatively harmless	*
2	Practically nontoxic	*
3	Slightly toxic	1,000 - 10,000 ppm**
4	Moderately toxic	100 - 1,000 ppm
5	Highly toxic	10 - 100 ppm
6	Extremely toxic	Less than 10 ppm

* No limits are set in these two categories because of extremely low toxicity. The three aspects to guard against here are: (a) concentrations that may reduce available oxygen, (b) concentrations that may pose an explosion or fire hazard, and (c) concentrations that may reduce visibility or pose a housekeeping problem.

** ppm=parts of contaminant per million parts of air.

COMMON SUBSTANCES
(SOLVENTS)

Trade Names	Chemical Composition	TLV	Hazard	Precautions
ACETONE dimethyl ketone, 2-propanone	acetone	1000 ppm	in very high concentrations acetone is a central nervous system depressant. slightly irritating to the skin the vapor is moderately irritating to the eyes Toxicity Rating 2	Use in a well ventilated area.
ALCOHOLS				
ETHYL HYDRATE ethanol, ethyl alcohol, algrain, anhydrol, cologne spirits, ethyl hydroxide, jaysol s, methyl carbinol, tecsol	ethanol	1000 ppm	relatively low toxicity if proper ventilation is maintained prolonged exposures to extremely high concentrations may produce irritation to the mucous membranes, headaches, dizziness, nausea and narcosis (inhalation) Toxicity Rating 2	Use in a well ventilated area.
ISOPROPYL ALCOHOL avantine, dimethyl carbinol, isohol, isopropanol, lutosol, petrohol, 2-propanol, i-propanol, sec-propyl alcohol	isopropyl alcohol	400 ppm	defatting agent central nervous system depressant absorbed easily through the skin, but due to its low toxicity, this is not a significant hazard (inhalation and skin absorption) Toxicity Rating 2-3	If exposure is long term, use in well ventilated area. Avoid prolonged skin contact.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
METHYL HYDRATE methanol, methyl alcohol, carbinol, wood alcohol, wood spirit, wood naphtha, pyroxylic spirit, pyroligneous spirit, colonial spirit, columbian spirit, methyl hydroxide, monohydroxymethane	methanol	200 ppm	exposure to high concentrations results in symptoms such as headaches, nausea, eye irritation. Very high concentrations can result in failure of vision skin absorption is a major route of entry into the body and contributes to the above symptoms (skin absorption and inhalation) Toxicity Rating 4	A respirator* or local exhaust ventilation is required when airborne concentrations are high. Skin contact must be avoided. The appropriate gloves or barrier cream should **always** be worn when using this material. For many applications it is possible to substitute with the less toxic ethanol or isopropanol.
HYDROCARBONS				
BENZENE benzine, benzin, nitration benzene, benzol (e), benzolene, bicarburet of hydrogen, carbon oil, coal naphtha, cyclohexatriene, motor benzol, mineral naphtha phene, phenyl hydride, pyrobenzol (e)	benzene	10 ppm (may be lowered)	central nervous system depressant irritant to the mucous membranes causes blood abnormalities can cause aplastic anemia (inhalation and skin absorption) Toxicity Rating 6	If possible, eliminate the use of this substance in the workshop Substitutes such as toluene or xylene can be used. If it is necessary to use benzene, do so **only** with adequate local exhaust ventilation and the proper chemical gloves.
BENZINE	Hydrocarbon mixture obtained from petroleum naphtha, distilling between 30° and 90°C. and consisting principally of n-pentane and n-hexane.		central nervous system depressant irritant to the mucous membranes n-hexane is toxic to the nervous system skin irritant and defatting agent (inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
GASOLINE	Aliphatic hydrocarbon, mostly a mixture of C_5 to C_{12} distilling between 40° and 225°C. Regular gasoline has low benzene content but contains tetraethyl lead. Unleaded gasoline has a higher benzene content.		narcotic irritating to the mucous membranes skin irritant and defatting agent tetraethyl lead is absorbed through the skin and may cause lead poisoning in unleaded gasoline, benzene exposure, with its toxic effect on the blood, becomes significant Toxicity Rating 4	Substitute the other hydrocarbon solvents such as Stoddard solvent or naphtha.
KEROSENE coal oil	Petroleum product distilling between 175° and 325°C.		central nervous system depressant irritating to mucous membranes skin irritant and defatting agent (small % skin absorption due to aromatic content, inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.
LITHOTINE	(see Stoddard Solvent and/or mineral spirits) 90-97%, pine oil, castor oil.	100 ppm	central nervous system depressant irritating to mucous membranes skin irritant and defatting agent (can have small % of skin absorption depending on the solvent used, inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
MINERAL SPIRITS petroleum spirits, mineral thinner, mineral turpentine, painters naphtha, solvent naphtha, varnish makers' naphtha, varnish makers' and painters naphtha (VM. & P. naphtha), benzoline, canadol, ligroin	Petroleum product distilling between 95° and 175°C. Consists chiefly of C_7 - C_{10} aliphatic hydrocarbons, but composition can vary widely as any one of several fractions within this boiling range may be used.		central nervous system depressant irritating to mucous membranes skin irritant and defatting agent (inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.
NAPHTHA	Petroleum product distilling between 30° and 238° C. Predominantly consisting of aliphatic hydrocarbons C_5 - C_{13}.		central nervous system depressant irritating to mucous membranes skin irritant and defatting agent (inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.
TOLUENE toluol, methyl benzene, methyl benzol, methacide, phenylmethane	toluene	100 ppm	central nervous system depressant skin irritant and defatting agent irritant to the mucous membranes (skin absorption and inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.
TURPENTINE	Distilled from pine resin, consisting of α-pinene and β-pinene. Composition varies with source.	100 ppm	central nervous system depressant irritating to mucous membranes primary skin irritant which may be more irritating than the above hydrocarbons because of impurities such as formaldehyde, phenols and the oxidation	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
			products of the major constituents. (inhalation) Toxicity Rating 4	
VARSOL, STODDARD SOLVENT	Higher boiling range of petroleum naphtha distilling between 150° and 210°C, consists of a	100 ppm	central nervous system depressant irritating to mucous membranes	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be
XYLENE xylol, dimethyl benzene	xylene	100 ppm	central nervous system depressant skin irritant and defatting agent irritating to mucous membranes (skin absorption and inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.
OPEX LACQUER THINNER #9	toluene methanol ethyl acetate and/or methyl ethyl ketone, isobutyl acetate and/or n-butyl acetate		narcotic irritating to mucous membranes skin irritant (methanol is absorbed through the skin) and defatting agent chronic exposure to high concentrations of methanol can result in eventual failure of vision (skin absorption and inhalation) Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Skin contact must be avoided. The appropriate gloves or barrier cream should always be worn when using this material.

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* The normal use of a respirator is for emergencies; it is not a preferred method of control. Don't forget that a respirator only protects the wearer.

ACIDS

Trade Names	Chemical Composition	TLV	Hazard	Precautions
ACETIC ACID	acetic acid	10 ppm	primary skin irritant concentrated liquid causes severe burns; this hazard is reduced by dilution, i.e.: 50% to 80% causes moderate to severe burns; below 50%, relatively mild injury; at concentrations below 10%, no injury should occur the effects of eye contact follow a similar pattern the vapor is highly irritating to the mucous membranes Toxicity Rating 5 (concentrated acid)	Avoid skin and eye contact. Wear the appropriate gloves; use eye protection, especially when handling the concentrated material. If vapor concentration is high, then a respirator or local exhaust ventilation should be used.
CARBOLIC ACID	phenol	5 ppm	primary skin irritant which can cause inflammation, dermatitis and in some cases gangrene phenol is easily and rapidly absorbed through the skin in toxic and even fatal amounts the vapor is highly irritating to the eyes, nose and upper respiratory tract	Avoid skin and eye contact. Wear the appropriate gloves and use eye protection. Use only under well ventilated conditions, preferably with local exhaust ventilation.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
			can cause systemic poisoning which affects the central nervous system, lungs, liver, kidneys and heart chronic poisoning is characterized by digestive disorders, nervous disorders, skin eruptions and liver and kidney damage Toxicity Rating 6	
CHROMIC ACID	chromic acid	0.05 mg/m^3	powerful skin irritant; the corrosive action on the skin leads to deep penetrating, slow healing ulcers at lower concentrations chromic acid causes eczematous dermatitis and is a **sensitizer** inhalation of the mist can cause perforation of the nasal septum Toxicity Rating 6	The appropriate gloves and eye protection **must** be worn when using this material at any concentration. If misting is possible, then local exhaust ventilation must be used.
CITRIC ACID β-hydroxytricaballylic acid	citric acid		concentrated solutions are moderately irritating to the skin has some allergenic properties Toxicity Rating 2 - 3	Wear the appropriate gloves and use eye protection when handling concentrated solutions.
GALLIC ACID	gallic acid (syn.) 3, 4, 5-trihydroxy benzoic acid		mild skin irritant Toxicity Rating 2 - 3	Wear the appropriate gloves when handling concentrated solutions.

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Trade Names	Chemical Composition	TLV	Hazard	Precautions
HYDROCHLORIC ACID muriatic acid	hydrochloric acid	5 ppm	primary skin irritant; solution causes severe burns emits hydrogen chloride fumes which irritate the mucous membranes of the eyes, nose and upper respiratory tract Toxicity Rating 4 - 5	Wear the appropriate gloves and use eye protection. For extensive use, where hydrogen chloride concentrations can rise above the TLV, local exhaust ventilation is necessary.
HYDROFLUORIC ACID	hydrofluoric acid	3 ppm	extremely irritating and corrosive to the skin produces severe, slow healing burns; gangrene of the affected areas may follow even dilute solutions can be extremely damaging to the skin the vapor, hydrogen fluoride, is extremely irritating to the mucous membranes of the eyes, nose and upper respiratory tract chronic effects include loss of weight, anemia and dental problems Toxicity Rating 5	Skin and eye contact must be avoided. Wear the appropriate gloves and use eye protection. This material should be used with adequate local exhaust ventilation. In case of accidental skin contact, wash with copious amounts of water and obtain medical attention.
NITRIC ACID aqua fortis azotic acid	nitric acid	2 ppm	solutions of nitric acid are highly corrosive and will produce severe burns to the skin and eyes nitric acid vapor is also corrosive to the skin, the mucous membranes of the eyes, nose and upper respiratory tract and to dental enamel Toxicity Rating 5	Wear the appropriate gloves. Use eye protection, especially when handling the concentrate. With highly concentrated solutions and for etching, local exhaust ventilation should be used.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
OLEIC ACID	oleic acid		none	None required.
OXALIC ACID	oxalic acid	1 mg/m^3	can cause severe burns to the skin, eyes and mucous membranes either as a dust or a solution even concentrations of 5% to 10% can be irritating poison if ingested Toxicity Rating 5	Wear the appropriate gloves and use eye protection.
PHOSPHORIC ACID	phosphoric acid	1 mg/m^3	a weak acid, less hazardous than nitric or sulfuric acid concentrated solutions are skin irritants Toxicity Rating 4	Wear the appropriate gloves and use eye protection, especially when handling concentrated solutions. Use in a well ventilated area.

POWDERS

Trade Names	Chemical Composition	TLV	Hazard	Precautions
ALUMINA HYDRATE	aluminum hydroxide	10 mg/m^3	nuisance dust only Toxicity Rating 1	If operation is dusty, use a dust mask.
ASPHALTUM (powdered) mineral pitch, bitumen	complex mixture of high molecular weight hydrocarbons	5 mg/m^3	there is a continuing debate as to whether inhalation of, or skin contact with, asphalt can produce cancer in humans Toxicity Rating 4	Because of the possibility that asphalt may produce cancer, skin contact and inhalation of dust or fumes should be avoided. Wear a dust mask and use the appropriate barrier creams or gloves.
BARYTES (WHITE)	barium sulfate	10 mg/m^3	long or intense exposure to dust leads to a benign pneumoconiosis Toxicity Rating 2	If operation is dusty, use a dust mask.
CRYSTOLON ABRASIVE GRAIN carborundum	silicon carbide		nuisance dust Toxicity Rating 2	If operation generates excessive dust, wear a dust mask. Wetting reduces dust levels appreciably.
DRAGON'S BLOOD	wood resin		no toxicological data available	If operation generates excessive dust, wear a dust mask.
MAGNESIUM CARBONATE, carbonic acid, magnesium salt, hydromagnesite, magnesite	magnesium carbonate		nuisance dust only Toxicity Rating 1	If operation is dusty, use a dust mask.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
PUMICE	complex silicates, chiefly aluminum silicate	10 mg/m^3	very little toxicological information available	If operation generates excessive dust, wear a dust mask. Wetting reduces dust levels.
RED OXIDE	iron oxide	10 mg/m^3	nuisance dust long or intense exposure may cause a benign pneumoconiosis Toxicity Rating 3	If operation generates excessive dust, wear a dust mask.
ROSIN	mainly abietic anhydride		may be an allergen	If operation generates excessive dust, wear a dust mask.
TALC French chalk	hydrated magnesium silicate	10 mg/m^3	no short term toxic effects chronic inhalation may lead to benign pneumoconiosis; symptoms include shortness of breath, cough and fatigue chronic excessive exposure can lead to pulmonary fibrosis (formation of fibrous tissue in lungs) some talcs contain asbestos which has been linked to lung cancer and peritoneal cancer (cancer of the membrane lining and abdominal pelvic walls) Toxicity Rating 3	Use Certified Asbestos Free talc, which is available as a high or cosmetic grade of talc. If operation generates excessive dust, wear a dust mask.
WHITING	calcium carbonate	10 mg/m^3	nuisance dust only Toxicity Rating 1	If operation generates excessive dust, wear a dust mask.

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INTAGLIO

Trade Names	Chemical Composition	TLV	Hazard	Precautions
AMMONIA	ammonia	25 ppm	vapor is irritating to the mucous membranes of the eyes, nose and upper respiratory tract concentrated solutions have a corrosive effect on the skin and eyes, causing burns dilute solutions are defatting agents on the skin and can lead to dermatitis Toxicity Rating 5	Use under well ventilated conditions. Local exhaust ventilation or a respirator is required for prolonged use when vapor concentrations are expected to be high. Wear the appropriate gloves or barrier cream and use eye protection.
BURNT PLATE OIL	boiled linseed oil		can be an allergen with chronic exposure Toxicity Rating 1 - 2	None required.
EMPIRE RESIST REMOVER CONCENTRATE	potassium hydroxide solution	2 mg/m^3	corrosive action on skin and eyes; concentrated solutions produce deep, painful destruction of tissues dilute solutions will emulsify and dissolve natural skin fats, and may lead to dermatitis mists will cause irritation to the eyes and respiratory tract and erode the nasal septum heating leads to easier formation of mists Toxicity Rating 4	Prevent skin and eye contact by wearing the appropriate gloves or barrier cream and by using eye protection. If misting can occur, local exhaust ventilation is necessary or a respirator approved for alkali mists can be worn.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
ETCHES				
DUTCH MORDANT	hydrochloric acid potassium chlorate water		hydrochloric acid is a primary skin irritant; the solution causes severe burns in the mordant, chlorine gas is evolved which is extremely irritating to the mucous membranes of the eyes, nose and upper respiratory tract; the irritating properties usually prevent severe overexposure Toxicity Rating 5	Avoid skin contact during the mixing of an etch as well as throughout the etching process. Wear appropriate gloves. Use eye protection, especially when handling concentrated acid. Local exhaust ventilation should be used for the etching area.
FERRIC CHLORIDE ETCH	ferric chloride water		ferric chloride hydrolizes in solution producing hydrochloric acid which is irritating to the eyes and skin Toxicity Rating 4	Skin and eye contact should be avoided with undiluted solution. Wear eye protection and gloves.
NITRIC ACID ETCH	nitric acid water		solutions of nitric acid are highly corrosive and will produce severe burns to the skin and eyes the vapor is also corrosive to the skin, to the mucous membranes of the eyes, nose and upper respiratory tract and to dental enamel Toxicity Rating 5	Avoid skin contact during the mixing of an etch as well as throughout the etching process. Wear gloves. Use eye protection, especially when handling the concentrate. Local exhaust ventilation should be used for etching.
NON-ETCH DESCUM SOLUTION	water sulfuric acid		concentrated solutions cause severe skin burns repeated skin contact with low concentrations causes drying of the skin and ulceration of the hands	Wear the appropriate gloves and eye protection.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
			eye contact is particularly serious with possible effects such as deep corneal ulceration and inflammation of the cornea and conjunctiva the mist is irritating to the mucous membranes of the eyes, nose and upper respiratory tract Toxicity Rating 4	
PHOTO RESISTS				
KMER KODAK METAL ETCH RESIST	xylene light sensitive polymer	100 ppm	xylene is a central nervous system depressant, a skin irritant, a defatting agent, an irritant to the mucous membranes, and is absorbed through the skin Toxicity Rating 4	Use only under well ventilated conditions. Local exhaust or respirator should be used in areas where general ventilation is inadequate. Use appropriate gloves or barrier cream.
KMER KODAK METAL ETCH RESIST DEVELOPER	xylene Stoddard solvent	100 ppm 100 ppm	xylene is a central nervous system depressant, a skin irritant, a defatting agent, an irritant to the mucous membranes and is absorbed through the skin Stoddard solvent is a central nervous system depressant, an irritant to the mucous membranes and it is a skin irritant and defatting agent Toxicity Rating 4	Use only under well ventilated conditions. Local exhaust or respirator should be used in areas where general ventilation is adequate. Use appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
KPR KODAK PHOTO RESIST	methyl cellosolve acetate (syn.) ethylene glycol monomethyl ether acetate or 2-methoxy ethyl acetate light sensitive polymer	25 ppm	methyl cellosolve acetate is easily absorbed through the skin; it also causes slight irritation of the outer skin surface can cause liver, kidney and brain damage heating this material causes high vapor concentrations Toxicity Rating 5	Use only under well ventilated conditions. Use with local exhaust ventilation or if use is infrequent and others will not be affected, a respirator can be used. Skin contact must be avoided. The appropriate gloves or barrier cream should always be worn when using this material.
KPR DEVELOPER	xylene methyl cellosolve acetate (syn.) ethylene glycol monomethyl ether acetate or 2-methoxy ethyl acetate	100 ppm 25 ppm	xylene is a central nervous system depressant, a skin irritant, defatting agent, an irritant to the mucous membranes and is absorbed through the skin methyl cellosolve acetate can cause liver, kidney and brain damage and is easily absorbed through the skin Toxicity Rating 4 - 5	Use only under well ventilated conditions. Use with local exhaust ventilation or if use is infrequent, and others will not be affected, a respirator can be used. Skin contact must be avoided. The appropriate gloves or barrier cream should always be worn when using this material.
KPR THINNER	methyl cellosolve acetate (syn.) ethylene glycol monomethyl ether acetate or 2-methoxy ethyl acetate	25 ppm	methyl cellosolve acetate is easily absorbed through the skin; it also causes slight irritation of the outer skin surface can cause liver, kidney and brain damage Toxicity Rating 5	Use only under well ventilated conditions. Use with local exhaust ventilation or if use is infrequent, and others will not be affected, a respirator can be used. Skin contact must be avoided. The appropriate gloves or barrier cream should always be worn when using this material.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
CHRISTIE V 149 VACOTOP ENAMEL PART A	polyvinyl alcohol		no apparent problem Toxicity Rating 1 - 2	
CHRISTIE SENSITIZER FOR V 149 PART B	inorganic chromate		powerful oxidizing agent; the corrosive effect of the concentrated solutions on the skin leads to deep penetrating, slow healing ulcers at lower concentrations it may cause eczematous dermatitis and it is a **sensitizer** inhalation of the mist can cause perforation of the nasal septum and is highly irritating Toxicity Rating 6	The appropriate gloves and eye protection are necessary when mixing these materials, PART A & B. If mist is possible, then local exhaust ventilation is necessary.
PARTS A & B (together)	600 ml. PART A 40 ml. PART B		only the hazards associated with a dilute chromate solution are applicable here Toxicity Rating 5	The appropriate gloves and eye protection are necessary when handling this material at any concentration. If exposure to mist is possible, then local exhaust ventilation is necessary.
CHRISTIE V145 ENAMEL FIXER-HARDENER	chromic acid	0.05 mg/m^3	powerful skin irritant; the corrosive action on the skin leads to deep penetrating, slow healing ulcers at lower concentrations chromic acid causes eczematous dermatitis and is a **sensitizer**	The appropriate gloves and eye protection must be worn when using this material at any concentration. If misting is possible, then local exhaust ventilation must be used.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
			inhalation of the mist can cause perforation of the nasal septum Toxicity Rating 6	
SPRAY LACQUER	composition varies with each brand		main hazard will be from overexposure to solvents and propellants	Use with adequate ventilation. If use is frequent or prolonged in an area where others are likely to be affected, local exhaust ventilation is necessary. If use is short term and not a standard procedure and others will not be affected, a respirator could be used in an area with general ventilation.

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LITHOGRAPHY

Trade Names	Chemical Composition	TLV	Hazard	Precautions
AMMONIUM NITRATE	ammonium nitrate		low toxicity except by ingestion Toxicity Rating 1 - 2	Avoid accidental ingestion
AMMONIUM PHOSPHATE	ammonium phosphate		low toxicity Toxicity Rating 1 - 2	None required.
CITRO-SKUM OFF	mineral acids thickeners water (pH 1.5)		mineral acids are primary skin irritants	Wear the appropriate gloves or barrier cream when handling this material.
EEZY KOTE DIAZO POWDER (PART A)	p-diazodiphenyl amine plus p-formaldehyde recovered as zinc chloride salt		Toxicity Unknown	Handle with care. Avoid breathing dust. Wear a dust mask if large quantities are used.
EEZY KOTE NEGATIVE COATING SOLUTION (PART B)	water organic acids leveling agents			
EEZY KOTE EMULSIFIED PN DEVELOPER	gum arabic solution, epoxy resins, aliphatic ketone, ester & alcohol solvents, aliphatic solvents, organic acids, inorganic acids		gum arabic and epoxy resins can cause allergic-type reactions the solvents are narcotic and skin irritants Toxicity Rating 3 - 4	Avoid prolonged use without adequate ventilation. Avoid eye contact. Wear the appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
FOTOMER DEVELOPER #924	water lithium benzoate surfactants n-propanol benzyl alcohol		irritants to mucous membranes skin irritants the alcohols (n-propanol and benzyl alcohol) are narcotic Toxicity Rating 3	Avoid prolonged use without adequate ventilation. Minimize skin contact.
GUMS & GUM SOLUTIONS				
GUM ARABIC arabin, calcium gumate, gum acacia, gum mimosa, African gum	natural substance no exact chemical composition, contains calcium salts of arabic acid		(As a powder) sensitizer, can cause allergic reaction can cause asthma-like symptoms can inflame nasal mucosa, sinuses, throat, respiratory tract and bronchia (exposure to dust or mist of gum arabic can initiate these symptoms) (inhalation) Toxicity Rating 3	Wear a respirator when dusts or mists are formed with gum arabic.
SINVALCO #16 GUM ARABIC	water gum arabic		(As a solution) very little hazard unless used as a mist Toxicity Rating 1 - 2	Wear a respirator when dusts or mists are formed.

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Trade Names	Chemical Composition	TLV	Hazard	Precautions
PREPASOL	water gum arabic hydrochloric acid		hydrochloric acid is an irritant to the eyes and skin Toxicity Rating 2	Avoid skin and eye contact.
VICTORY ETCH	water gum arabic nitric acid bitumen		nitric acid is an irritant to eyes and skin Toxicity Rating 2	Avoid skin and eye contact.
EEZY KOTE GUM SEALER	gum arabic, aliphatic solvents, organic acids, asphaltum, aliphatic ketone solvents		gum arabic can cause allergic symptoms the remaining ingredients are skin irritants and defatting agents and can lead to dermatitis Toxicity Rating 2 - 3	Avoid eye contact. Wear the appropriate gloves or barrier cream.
CELLULOSE GUM	carboxy methyl cellulose (syn.) cellulose glycolic sodium salt (CMC)		very low toxicity by all normal routes Toxicity Rating 1	None required.
HANCO CELLULOSE GUM SOLUTION	water cellulose gum phosphoric acid trace phenol		very low toxicity by all normal routes 2% phosphoric acid could be irritating if solution is splashed in the eye Toxicity Rating 1	If splashed in the eyes rinse thoroughly with water.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
HANCO CELLULOSE GUM ETCH (ACIDIFIED)	water cellulose gum magnesium salts phosphoric acid		very low toxicity by all normal routes 1% phosphoric acid could be irritating if solution is splashed in the eye Toxicity Rating 2	If splashed in the eyes rinse thoroughly with water.
LACQUERS				
LACQUER C VINYL BASE LACQUER	aromatic hydrocarbon ketone resin	100 ppm 5 ppm	the ketone is highly irritating to the mucous membranes of the eyes, nose and upper respiratory tract; it is also a narcotic the aromatic hydrocarbon solvent used here is a primary skin irritant and defatting agent as well as a central nervous system depressant. Skin absorption is significant (inhalation and skin absorption) **Toxicity Rating 5**	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves and barrier cream. The manufacturer recommends wearing safety glasses.

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Trade Names	Chemical Composition	TLV	Hazard	Precautions
LACQUER C SOLVENT	ketone	200 ppm	skin irritant and defatting agent irritant to the mucous membranes main danger is possibility of dermatitis from repeated or prolonged skin contact (inhalation) Toxicity Rating 3	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear appropriate gloves or barrier cream. The manufacturer recommends wearing safety glasses.
TITAN VINYL PLATE LACQUER	isophorone diacetone alcohol D.I.B.K. (di-isobutyl ketone) xylene	5 ppm 50 ppm 25 ppm 100 ppm	the ketone, isophorone is highly irritating to the mucous membranes of the eyes, nose and upper respiratory tract; it is also a narcotic xylene is a narcotic and a primary skin irritant and defatting agent (skin absorption and inhalation) Toxicity Rating 5	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
LEVELITE	methylene chloride toluene methanol methyl cellulose	200 ppm 100 ppm 200 ppm	methylene chloride is a central nervous system depressant; it is metabolized to carbon monoxide and exposure to high concentrations will give symptoms of carbon monoxide poisoning which are associated with reduced availability of oxygen to the tissues; this is of particular concern to people who may be predisposed to heart attack toluene is a narcotic, an irritant to the mucous membranes, a primary skin irritant and a defatting agent which is absorbed through the skin into the body methanol is also absorbed through the skin and eventually can lead to failure of vision (inhalation and skin absorption) Toxicity Rating 4	Use only in a well ventilated area. Avoid skin contact. Wear the appropriate gloves or barrier cream. A respirator* or local exhaust ventilation is necessary for high concentrations.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
PLASAVER	esters aromatic hydrocarbon (benzene) aliphatic hydrocarbon alcohol		the aromatic hydrocarbon is a central nervous system depressant, a skin irritant, a defatting agent and is irritating to the mucous membranes; it is also toxic to the blood-forming centers and can cause severe blood abnormalities Toxicity Rating 6 (the manufacturer claims to have recently removed benzene from the product, but old solutions and existing stock may still contain it)	Use with local exhaust ventilation. Avoid skin contact by wearing the appropriate gloves or barrier cream.
POTASSIUM DICHROMATE	potassium dichromate	0.05 mg/m^3	powerful oxidizing agent; the corrosive effect of the dust or concentrated solutions on the skin leads to deep penetrating, slow healing ulcers at lower concentrations it may cause eczematous dermatitis and it is a sensitizer inhalation of the dust or mist causes perforation of the nasal septum and is highly irritating Toxicity Rating 6	The appropriate gloves and eye protection are necessary when handling this material at any concentration. If exposure to dust or mist is possible, then local exhaust ventilation is necessary.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
PRO SOL FOUNTAIN SOLUTION	zinc nitrate ammonium dichromate phosphoric acid		corrosive to skin tissue can cause dermatitis Toxicity Rating 3 - 4	Avoid skin contact. Wear appropriate gloves or barrier cream.
SODIUM DICHROMATE	sodium dichromate	0.05 mg/m^3	powerful oxidizing agent; the corrosive effect of the dust or concentrated solutions on the skin leads to deep penetrating, slow healing ulcers at lower concentrations it may cause eczematous dermatitis and it is a **sensitizer** inhalation of the dust or mist causes perforation of the nasal septum and is highly irritating Toxicity Rating 6	The appropriate gloves and eye protection are necessary when handling this material at any concentration. If exposure to dust or mist is possible, then local exhaust ventilation is necessary.
STATI-KIL (aerosol)	isopropyl alcohol	400 ppm	defatting agent central nervous system depressant (inhalation and skin absorption) Toxicity Rating 2 - 3	Use in a well ventilated area. Avoid prolonged skin contact.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
VARN COMPOUND 747	long chain aliphatic hydrocarbon amorphous silica		skin irritant and defatting agent Toxicity Rating 3 - 4	Use in a well ventilated area. Avoid skin contact. Wear the appropriate gloves or barrier cream.
VARN PRESS CLEAN BLANKET WASH	aliphatic & aromatic hydrocarbons		narcotic skin irritants and defatting agents the aromatics are absorbed through the skin into the body (inhalation and skin absorption) Toxicity Rating 3	Use in a well ventilated area. Avoid skin contact. Wear appropriate gloves or barrier cream.
VARN SUPER RUBBER REJUVENATOR BLANKET WASH	cellosolve acetate (syn.) 2-ethoxy ethyl acetate or ethylene glycol monomethyl ether acetate	100 ppm	not irritating to the skin surface, but it is easily absorbed through it into the body can cause central nervous system depression and lung and kidney injury, but the vapor has sufficient warning properties to prevent overexposure high concentrations are irritating to the eyes, nose and upper respiratory tract Toxicity Rating 4	Use only in well ventilated areas. Local exhaust ventilation should be used if the TLV may be exceeded. A respirator* can be used for short term exposure. Wear the appropriate gloves or barrier cream.

SCREEN PRINTING

Trade Names	Chemical Composition	TLV	Hazard	Precautions
BINDER VARNISH	resins plasticizers solvents: mineral spirits, denatured ethanol, terpene, aromatic hydrocarbon solvent	 100 ppm 1000 ppm 100 ppm	mineral spirits, terpene and aromatic hydrocarbons are all central nervous system depressants they are irritating to the mucous membranes of the eyes, nose and upper respiratory tract they are skin irritants and defatting agents and may cause dermatitis upon prolonged or repeated exposure aromatic hydrocarbon solvents are absorbed through the skin into the body Toxicity Rating 4	Use only in a well ventilated area. Wear the appropriate gloves or barrier cream.
BLOCKOUTS				
LEPAGES LIQUID STRENGTH GLUE	water hide glue protein extract urea preservative		Toxicity Unknown (animal glues are often allergenic)	

Trade Names	Chemical Composition	TLV	Hazard	Precautions
SUPER BLOX	methylene chloride methanol methyl cellulose water	200 ppm 200 ppm	methylene chloride is a central nervous system depressant; it is metabolized to carbon monoxide and exposure to high concentrations will give symptoms of carbon monoxide poisoning which are associated with reduced availability of oxygen to the tissues; this is of particular concern to people who may be predisposed to heart attack exposure to high concentrations of methanol results in symptoms such as headaches, nausea, eye irritation and damage; it is easily absorbed into the body through the skin Toxicity Rating 4	Use only in a well ventilated area. Avoid skin contact. Wear the appropriate gloves or barrier cream. A respirator or local exhaust ventilation is necessary for high concentrations.
ULANO BLOCKOUT	confidential		none	None required

Trade Names	Chemical Composition	TLV	Hazard	Precautions
INKS AND THINNERS				
FLAT FINISH INKS	resins pigments solvents: mineral spirits, denatured ethanol, terpene, aromatic hydrocarbon solvent	100 ppm 1000 ppm 100 ppm	mineral spirits, terpene and aromatic hydrocarbons are all central nervous system depressants they are irritating to the mucous membranes of the eyes, nose and upper respiratory tract they are skin irritants and defatting agents and may cause dermatitis upon prolonged or repeated exposure aromatic hydrocarbon solvents may be absorbed through the skin into the body Toxicity Rating 3 - 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.
FLAT FINISH THINNER FLAT FINISH RETARDING THINNER FLAT FINISH FAST THINNER	mineral spirits aliphatic hydrocarbon solvent aliphatic hydrocarbon solvent	100 ppm	central nervous system depressants irritating to the mucous membranes of the eyes, nose and upper respiratory tract skin irritants and defatting agents Toxicity Rating 3 - 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
PLASTI-VAC GLOSS INKS	pigments resins solvents: butyl cellosolve, isophorone, cellosolve acetate, diacetone alcohol, aromatic hydrocarbon solvent	 50 ppm 5 ppm 25 ppm 50 ppm 100 ppm	BUTYL CELLOSOLVE irritating to the eyes, nose and upper respiratory tract only mildly irritating to the skin surface but is easily absorbed through it in toxic amounts injurious to the blood, liver and kidneys ISOPHORONE highly irritating to the mucous membranes of the eyes, nose and upper respiratory tract; it is also a central nervous system depressant DIACETONE ALCOHOL defatting agent which may cause dermatitis upon prolonged or frequently occurring contact irritating to the eyes, nose and upper respiratory tract CELLOSOLVE ACETATE not irritating to the skin surface, but it is easily absorbed through it into the body can cause central nervous system depression and lung and kidney injury	The following precautions apply to the Plasti-Vac Gloss Inks, Plasti-Vac Thinner and Plasti-Vac Retarder Thinner: Avoid skin and eye contact. The appropriate gloves or barrier cream should always be worn when handling these materials. Use eye protection. Local exhaust ventilation is necessary; a respirator may be worn if others would not be affected in the environment and if there is general ventilation.
PLASTI-VAC THINNER and PLASTI-VAC RETARDER THINNER	butyl cellosolve, isophorone, cellosolve acetate, diacetone alcohol, aromatic hydrocarbon solvent (same as for ink solvents, except % differs)			

Trade Names	Chemical Composition	TLV	Hazard	Precautions
OVERPRINT CLEAR	alkyd resins driers additives aromatic hydrocarbon solvent		the significant hazard here is with the aromatic hydrocarbon solvent: central nervous system depressant skin irritant and defatting agent; may cause dermatitis upon prolonged or frequent contact aromatic hydrocarbons are absorbed through the skin into the body Toxicity Rating 3 - 4	Use only in a well ventilated area. Wear the appropriate gloves or barrier cream.
SCREEN WASH 70-184	toluene butyl acetate isopropanol	100 ppm 150 ppm 1000 ppm	toluene is a central nervous system depressant, an irritant to the mucous membranes of the eyes, nose and upper respiratory tract, and an irritant to the skin; may cause dermatitis upon repeated or prolonged contact; it is absorbed through the skin into the body butyl acetate is a central nervous system depressant, and an irritant to the mucous membranes of the eyes, nose and upper respiratory tract Toxicity Rating 4	Use only under well ventilated conditions. If airborne concentrations are high, local exhaust ventilation should be used. For a short exposure a respirator* may be used. Wear the appropriate gloves or barrier cream.

Trade Names	Chemical Composition	TLV	Hazard	Precautions
SCOTCH BRAND SANDBLAST FILLER #2	naphthenes and paraffins aromatics olefins		central nervous system depressant irritating to the mucous membranes of eyes, nose and upper respiratory tract skin irritant and defatting agent the aromatic content will be absorbed by the skin Toxicity Rating 3 - 4	Use only under well ventilated conditions. Avoid breathing the fumes; use a respirator if necessary. Wear the appropriate gloves or barrier cream.
TOOSH GLUE & LACQUER RESIST	mineral spirits inert pigments vehicle solids		the significant hazard here is mineral spirits: central nervous system depressant irritating to the mucous membranes skin irritant and defatting agent Toxicity Rating 3 - 4	Use only in a well ventilated area. Wear the appropriate gloves or barrier cream if skin contact is expected.
TRANSPARENT BASE 5530	resins plasticizers thickener solvents mineral spirits		the only significant hazard is with the solvent: mineral spirits is a central nervous system depressant, an irritant to the mucous membranes, and a skin irritant and defatting agent Toxicity Rating 3 - 4	Use only in a well ventilated area. Wear the appropriate gloves or barrier cream.

Trade Names		Chemical Composition	TLV	Hazard	Precautions
TSP CLEANER		tribasic sodium phosphate		strongly alkaline and therefore a primary skin irritant; irritation may eventually lead to dermatitis eye contact with dust or solution will cause severe eye damage Toxicity Rating 4	Avoid skin and eye contact.
ULANO HI-FI DEVELOPER	PART A	organic acid		Part A is an acidic powder; Parı B is alkaline; the powders can be irritating to the skin and mucous membranes the solution gives rise to hydrogen peroxide which in low concentrations is mildly irritating eye contact can cause damage	Wear the appropriate gloves or barrier cream. Avoid splashing.
	PART B	peroxide-forming compound			

Cherie Moses, James Purdham, Dwight Bowhay, Roland Hossein, Health and Safety in Printmaking, a manual for printmakers, Alberta Labour Occupational Health and Safety Div., Hygiene Branch, Edmonton, Alberta, January, 1978.

SOLVENTS USED IN GRAPHIC ARTS

SOLVENTS USED IN GRAPHIC ARTS

1. Check with the teacher when in doubt about which solvent to use.
2. Wear splash-proof safety goggles to protect the eyes. Eyewash stations should be available to flush the eyes in case of chemical splashes. Flush the eyes with running water for ten minutes and seek immediate medical attention.
3. Avoid skin contact with solvents. Rubber or plastic gloves are recommended. Never let solvents come into contact with raw cuts, or skin that is cracked or reddened, since many solvents can be absorbed through the skin.
4. After working with solvents, wash the hands thoroughly with soap and water.
5. Do not eat or leave food near solvents.
6. Use solvents only in well-ventilated areas. Be sure the exhaust fans are turned on.
7. Do not use solvents near open fire or flame. Never use a solvent with a flash point of less than 100° F.
8. Never use gasoline or benzine in the Graphic Arts Lab.
9. Label all solvent and chemical containers with clear and concise labels.
10. Store chemicals and solvents in approved metal or plastic containers. Bulk chemicals should be kept in metal fireproof cabinets.

GRAPHIC ARTS SOLVENTS

NAME	USAGE	INGREDIENTS	TOXICITY	PRECAUTIONS
Amisol cleaner	General press and type cleaning	Mineral spirits from petroleum	Medium	Protect eyes and clothes. Avoid prolonged skin contact Avoid breathing fumes. FLAMMABLE
Phenoid cleaner (Type wash)	Strong cleaner for softening dry ink and general clean-up	Toluol, mineral spirits, isopropanol, di-butyamine	High	Protect eyes and clothes. Avoid skin contact. Avoid breathing fumes. FLAMMABLE
Blanket wash	Fast-evaporating, non-oily cleaner for blankets on offset presses	Perchloroethylene and petroleum naphtha	Medium	Protect eyes and clothes. Avoid prolonged skin contact Avoid breathing fumes. FLAMMABLE
Turpentine	Solvent and thinner used in screen printing inks and clean-up	Resinous sap oil from pine and fir trees	Medium	Protect eyes and clothes. Avoid prolonged skin contact Avoid breathing fumes. FLAMMABLE
Lacquer thinner	Solvent and thinner used in screen printing inks and clean-up	Methanol and toluol	High	Protect eyes and clothes. Avoid skin contact. Avoid breathing fumes. FLAMMABLE
Bleach	Screen printing cleaner to remove photo emulsion	Sodium hypochlorite	Medium	Protect eyes and clothes. Avoid prolonged skin contact Avoid breathing fumes.

Note: Use all of the above in well-ventilated areas. Never use gasoline or benzine in Graphic Arts lab.

SOLVENTS SAFETY QUIZ

NAME________________________________

CLASS________________________________

DATE ________________GRADE______________

True-False:

T F 1. Most solvents are flammable.

T F 2. Gasoline is a good solvent to use in graphic arts.

T F 3. Exhaust fans should be operating when solvents are being used.

T F 4. Hands should be washed with soap and water after using solvents.

T F 5. Solvents may be used around food if the food is kept covered.

Multiple Choice:

_____ 6. If solvents or chemicals are splashed in the eyes, the pupil should: (a) flush the eyes with running water for ten minutes, (b) inform the teacher, (c) seek immediate medical attention, (d) do all of these, (e) do none of these.

_____ 7. Never use a solvent with a flash point of less than: 50 degrees F, (b) 100 degrees F, (c) 150 degrees F, (d) 200 degrees F.

_____ 8. Solvents and chemicals should be stored in containers made of (a) metal or plastic, (b) glass or metal, (c) plastic or glass, (d) any materials at all.

_____ 9. When working with solvents, the following protection should be worn: (a) apron and goggles, (b) rubber gloves and goggles, (c) apron and rubber gloves, (d) apron, goggles, and rubber gloves.

_____10. Two solvents with high toxicity are: (a) amisol and phenoid cleaner, (b) phenoid cleaner and lacquer thinner, (c) blanket wash and lacquer thinner, (d) blanket wash and turpentine.

______ 11. It is important to avoid skin contact with solvents if the skin has: (a) cracks, (b) reddened areas, (c) open cuts or sores, (d) all of these, (e) none of these.

______ 12. Solvents should be stored in metal fireproof containers to: (a) prevent evaporation, (b) reduce fire hazards, (c) keep them out of the way, (d) make them easy to find.

______ 13. Solvents, not gasoline, should be used for cleaning because they: (a) clean better, (b) evaporate faster, (c) will not catch fire as easily, (d) are cheaper to buy.

Matching: Place the letter of phrase that best describes the use of each solvent in the space to the left of that solvent.

_____ 14. Amisol cleaner

_____ 15 Phenoid cleaner

_____ 16. Blanket wash

_____ 17. Turpentine

_____ 18. Lacquer thinner

_____ 19. Bleach

A. Non-oily cleaner for offset blankets

B. Used in screen printing clean-up

C. Strong cleaner for softening dry ink

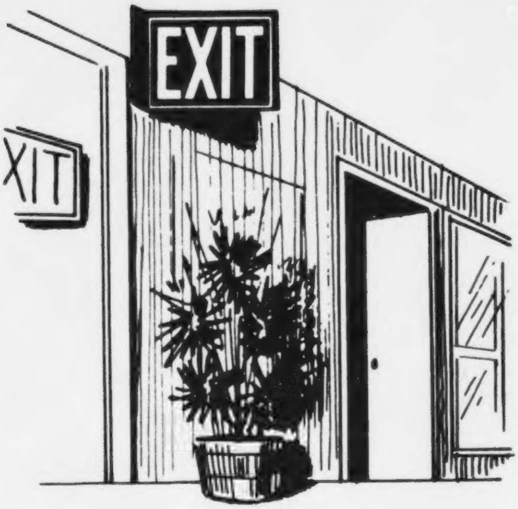
D. Used in screen printing to remove photo emulsion.

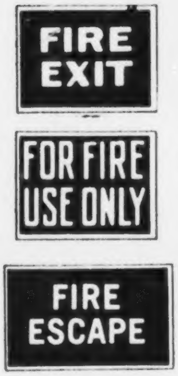
E. Used in screen printing clean-up

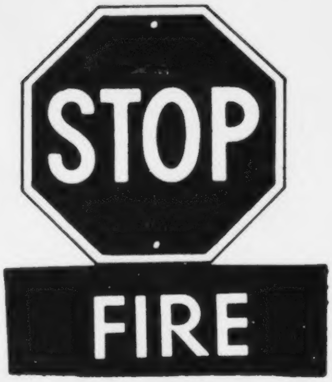
F. General press and type cleaning

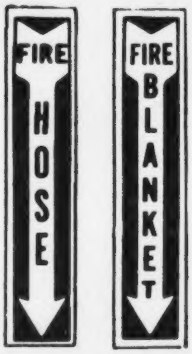
KEY

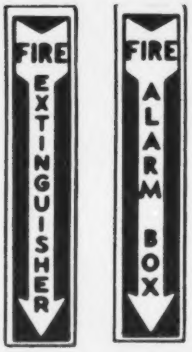
1. T
2. F
3. T
4. T
5. F
6. D
7. B
8. A
9. D
10. B
11. D
12. B
13. C
14. F
15. C
16. A
17. B
18. E
19. D



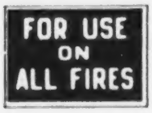

FIRE EXIT
FOR FIRE USE ONLY
FIRE ESCAPE

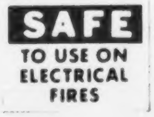


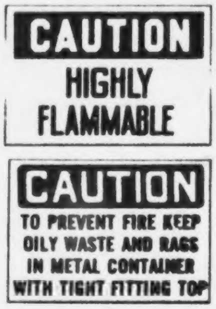

FIRE HOSE
FIRE BLANKET

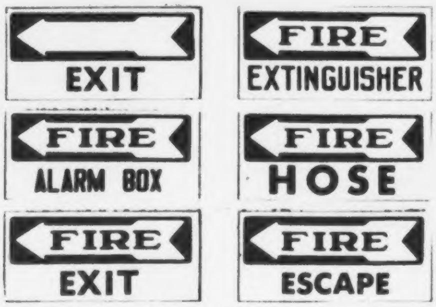

FIRE EXTINGUISHER
FIRE ALARM BOX

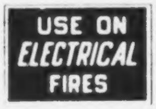
IN CASE OF FIRE, MAKE SURE THE LOCAL FIRE DEPARTMENT IS NOTIFIED BEFORE ANY ATTEMPT IS MADE TO FIGHT THE FIRE, REGARDLESS OF ANY ARRANGEMENTS MADE PREVIOUSLY WITH THE FIRE DEPARTMENT.

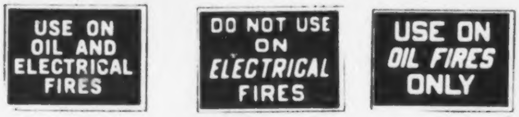

FOR USE ON ALL FIRES

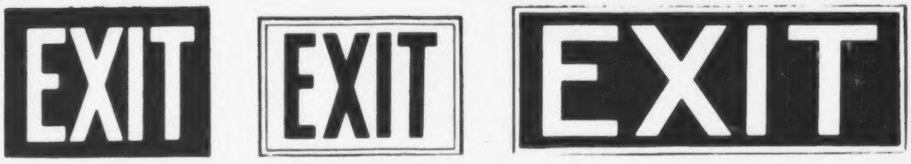

SAFE
TO USE ON ELECTRICAL FIRES


CAUTION
HIGHLY FLAMMABLE
CAUTION
TO PREVENT FIRE KEEP OILY WASTE AND RAGS IN METAL CONTAINER WITH TIGHT FITTING TOP


EXIT
FIRE EXTINGUISHER
FIRE ALARM BOX
FIRE HOSE
FIRE EXIT
FIRE ESCAPE


USE ON ELECTRICAL FIRES

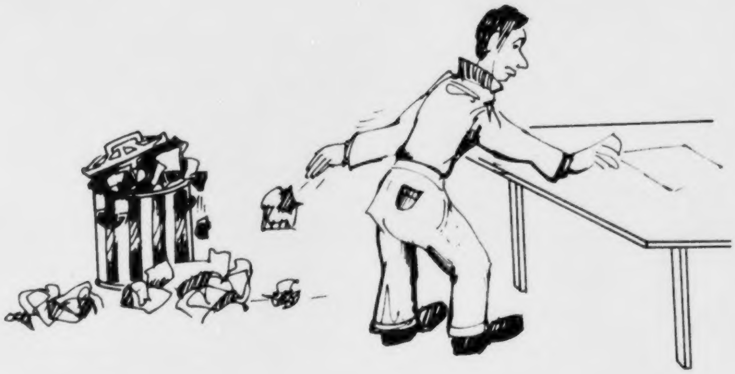

USE ON OIL AND ELECTRICAL FIRES
DO NOT USE ON ELECTRICAL FIRES
USE ON OIL FIRES ONLY


EXIT
EXIT
EXIT

FIRE PREVENTION AND PROTECTION

Fire may seem a remote possibility. However, it has been responsible, together with explosion, for the nation's worst school disasters. Fire Prevention Education should be included in the total pattern of educational experience. It is often said that an ounce of prevention is worth a pound of cure. This little bit of wisdom is probably more true about fire than of any other hazard.

In order of importance (next to educating the public about fire prevention) is the need for GOOD HOUSEKEEPING. The following suggestions may aid in preventing a fire that is "Looking for a Place to Happen."



1. Maintain a clean and orderly workplace.
2. Isolate combustible materials in fire-resistant areas.
3. Dispose of rubbish regularly.
4. Keep soiled mops, rags, and towels in covered metal containers.
5. Restrict use of vaporous combustibles to well-ventilated and spark-free areas.
6. Make regular building inspections or request an inspection from state or local fire officials.
7. Implement corrective procedures that may have been recommended from an inspection.

"BE PREPARED" is more than just a "Motto for Boy Scouts." "BEING PREPARED" IS AN ABSOLUTE MUST IN FIRE PROTECTION. In the event a fire should occur in a building, the primary concern is the safe evacuation of ALL PERSONNEL from the building. Regular fire drills (records must be kept), as required by state and local fire regulations, will aid in a safe and orderly evacuation of the facility if an emergency should arise. A plan for the orderly and safe evacuation should include the following:

1. A fire alarm system, distinct and recognizable as such with an alternate signal for the hard of hearing,
2. A well-planned evacuation route and an alternate route from all areas of the building,
3. Adult supervision of all evacuation routes until the building has been emptied.
4. A designated assembly area well away from the building,
5. A contingency plan for evacuation to another location in adverse weather when returning to the building is not feasible,
6. A method of accounting for all personnel after the evacuation,
7. Designated responsible persons (adults) to notify the fire department.

Since fire safety needs will vary from community to community, each district should prepare and adopt a program adequate to meet its needs. The program should be developed cooperatively with the local fire agency and must include the provisions set forth in legislative statutes.

CLASSIFICATION OF FIRE

A "FIRE" is a chemical reaction. For a fire to occur, FUEL (which can be any flammable or combustible material), OXYGEN (present in our atmosphere at all times), and TEMPERATURE (at or above the ignition level of the fuel) must all be present in the same place at the same time.

Fires are divided into four classes, depending on the type of fuel present:

1. TYPE A--fuel may be wood, paper, cloth, etc.
2. TYPE B--fuel may be gasoline, oil, grease, or flammable liquids of any type.
3. TYPE C--fuel may be electric motors, switches, or other devices that depend on electricity for operation.
4. TYPE D--fuel may be magnesium or other combustible metal. (Fires caused by this type of fuel must be handled by professional firefighters with specialized equipment. Therefore, this type will not be discussed in depth.)

Extinguishers are available for each different type of fire and are available in multiple classifications to use on more than one type of fire. CAUTION must be exercised in using only those extinguishers that are the correct type for the fire being fought; using the wrong type may prove dangerous. Refer to the accompanying chart (page 1871) for the correct type of extinguisher to use and how to use it.

CHECKED
1938
FIRE

FIRE DRILLS

THE FOLLOWING STATUTE IS TAKEN FROM THE HANDBOOK OF KANSAS LAWS.

22-18-2. Fire and Tornato Drills in Schools. (a) The administrators of all schools, both public and private, in the state of Kansas except community junior colleges, colleges, and universities, shall:

1. Conduct at least one (1) fire drill each month.
2. Fire drill shall be conducted during school hours aside from regular dismissal time at noon or at close of day's session.
3. Fire drill shall be unannounced and shall be conducted by the use of the regular fire alarm system.
4. Fire drill shall include all floors, wings, and sections of the building.
5. Every person shall vacate the building during the fire drill and teachers and administrators shall accompany their pupils from the building and account for each pupil within their authority.
6. All doors and exits shall be kept unlocked and unobstructed when building is occupied.
7. It shall be the duty of the school board or board of trustees of all schools, both public and private, to assure that such fire drills are conducted and true and accurate records of such drills are kept on forms provided by the state fire marshal, and posted in a conspicious location and filed with the state fire marshal at the end of each school year.
8. It shall also be the responsibility of said school boards that the fire alarm system in each school within their district is maintained in working order and shall be activated at all times during occupancy.

UNAUTHORIZED USE OF FIRE ALARM

The regular fire alarm system shall not be used for any other function, such as a tornado drill or a class change.

PORTABLE FIRE EXTINGUISHERS (OSHA REGULATIONS)

1. Portable fire extinguishers shall be maintained in a fully charged and operable condition and kept in their designated places.

2. Extinguishers shall be conspicuously located where they will be readily accessible and immediately available in the event of a fire.

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS (FEET)
Light	4B	50
Ordinary	8B	50
Extra	12B	50

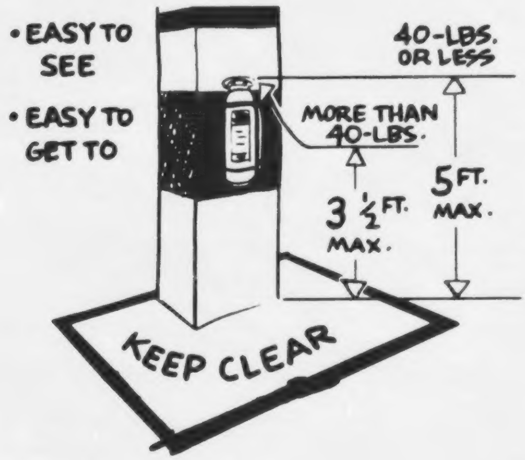
BASIC MINIMUM EXTINGUISHER RATING FOR AREA SPECIFIED	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS (FEET)	AREAS TO BE PROTECTED PER EXTINGUISHER		
		LIGHT HAZARD OCCUPANCY (SQUARE FEET)	ORDINARY HAZARD OCCUPANCY (SQUARE FEET)	EXTRA HAZARD OCCUPANCY (SQUARE FEET)
1A	75	3,000	-------	--------
2A	75	6,000	3,000	Note 1
3A	75	9,000	4,500	3,000
4A	75	11,250	6,000	4,000
6A	75	11,250	9,000	6,000

3. The locations and intended use of extinguishers shall be marked conspicuously.

4. Extinguishers designed for separate classes of fires shall be marked conspicuously.

5. Extinguishers shall be mounted on hangers or in the brackets supplied, put in unlocked cabinets, or set on shelves.

6. An extinguisher shall not be mounted higher than five feet (to the top of the extinguisher) if the extinguisher weighs forty pounds or less. If it weighs more than forty pounds, the extinguisher shall not be mounted higher than 3 1/2 feet (NIOSH)



7. The number and size of extinguishers needed to protect a property shall be determined as prescribed in OSHA.

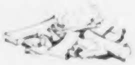
8. An extinguisher shall be examined at least yearly, recharged and/or repaired to assure operable condition and safety. A tag must be attached that shows the maintenance or recharge date and the signature or initials of the person performing the service. (NIOSH)

9. An extinguisher removed from the premises to be recharged shall be replaced by a spare extinguisher during its absence. (OSHA)

*NOTE: CARBON TETRACHLORIDE and other toxic vaporizing liquid fire extinguishers are extremely dangerous to the user and should be removed from service.

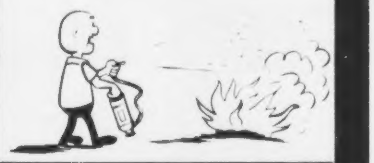
*NOTE: SODA ACID--WATER CARTRIDGE--FOAM--LOADED STREAM CARTRIDGE. These extinguishers have been labeled by some authorities as "ineffective and unreliable." Soda acid is to be phased out of use and is not rechargeable after the current hydrostatic test date has expired.

*NOTE: HALON 12H extinguishers are now permitted by state code. These are vaporizing liquid, rated basically B.C. Larger sizes are rated ABC rated.

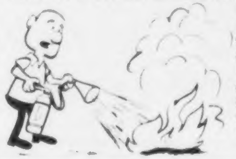
KIND OF FIRE	APPROVED TYPE OF EXTINGUISHER						
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . . ↓ . . .THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS →	MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT						
	FOAM Solution of Aluminum Sulphate and Bicarbonate of Soda	**CARBON DIOXIDE** Carbon Dioxide Gas Under Pressure	**SODA ACID** Bicarbonate of Soda Solution and Sulphuric Acid	**PUMP TANK** Plain Water	**GAS CARTRIDGE** Water Expelled by Carbon Dioxide Gas	**MULTI-PURPOSE DRY CHEMICAL**	**ORDINARY DRY CHEMICAL**
A CLASS A FIRES USE THESE EXTINGUISHERS →  ORDINARY COMBUSTIBLES • WOOD • PAPER • CLOTH ETC.	A B	✗	A	A	A	A B C	✗
B CLASS B FIRES USE THESE EXTINGUISHERS → FLAMMABLE LIQUIDS, GREASE • GASOLINE • PAINTS • OILS, ETC.	A B	B C	✗	✗	✗	A B C	B C
C CLASS C FIRES USE THESE EXTINGUISHERS → ELECTRICAL EQUIPMENT • MOTORS • SWITCHES ETC.	✗	B C	✗	✗	✗	A B C	B C

HOW TO OPERATE

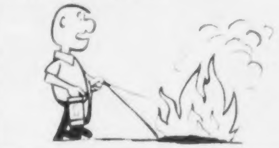
FOAM: Don't Play Stream into the Burning Liquid. Allow Foam to Fall Lightly on Fire.



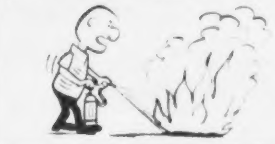
CARBON DIOXIDE: Direct Discharge as Close to Fire as Possible. First at Edge of Flames and Gradually Forward and Upward



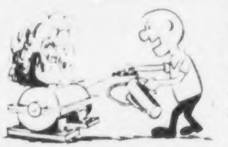
SODA ACID, GAS CARTRIDGE: Direct Stream at Base of Flame



PUMP TANK: Place Foot on Footrest and Direct Stream at Base of Flames



DRY CHEMICAL: Direct at the Base of the Flames. In the Case of Class A Fires, Follow Up by Directing the Dry Chemicals at Remaining Material That is Burning



IMPORTANT! USING THE WRONG TYPE EXTINGUISHER FOR THE CLASS OF FIRE MAY BE DANGEROUS!

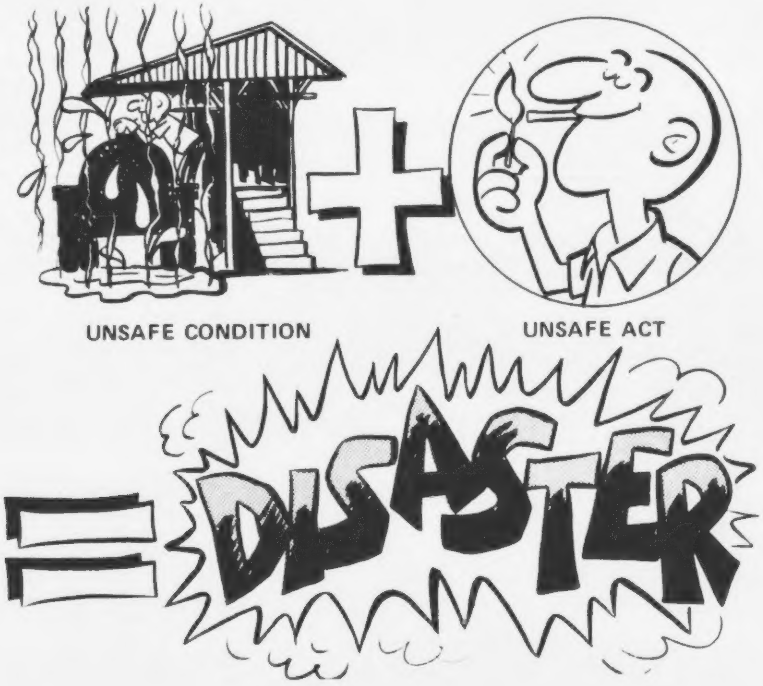
FIRE ALARM SYSTEMS

A complete fire alarm system may include three subsystems: The WARNING SYSTEM, the DETENTION SYSTEM, and the EXTINGUISHING SYSTEM.

WARNING SYSTEM--The warning system shall include warning bells or buzzers at strategic locations throughout the building which must be loud enough to be heard above the average noise levels in shops and music rooms. The warning system may even be connected into the local fire department. The system should also include an alternate system for the hard of hearing.

DETECTION SYSTEM--The detection system shall include devices designed for the specific need. Typical systems should include smoke detectors, flame detectors, and/or heat detectors.

EXTINGUISHING SYSTEM--This type of system will depend on the need in individual areas and can be determined by consultation with the local fire department. It may include automatic sprinklers of either the wet or dry types.



AUTOMATIC SPRINKLER SYSTEMS (NIOSH)

Automatic sprinkler systems must meet the design requirements of the National Fire Protection Association's Standard for the Installation of Sprinkler Systems, (NFPA No. 13-1969) as well as OSHA requirements.

1. Every automatic sprinkler system must have at least one automatic water supply of adequate pressure, capacity, and reliability.

2. One or more fire department connections, through which the fire department can pump water, is required. No shut-off valve is allowed in this connection.

3. The employer is responsible for the condition of the sprinkler system and must keep it in good operating order. Annual functional tests are a minimum requirement.

4. The clearance between sprinkler deflectors and the top of combustible storage must be at least 36 inches unless the material is in solid piles less than 15 feet high, or in piles less than 12 feet high with horizontal channels; in which case a minimum clearance of 18 inches is allowed. Commodities containing only small amounts of combustible material may be stored up to 18 inches from the sprinkler deflectors.

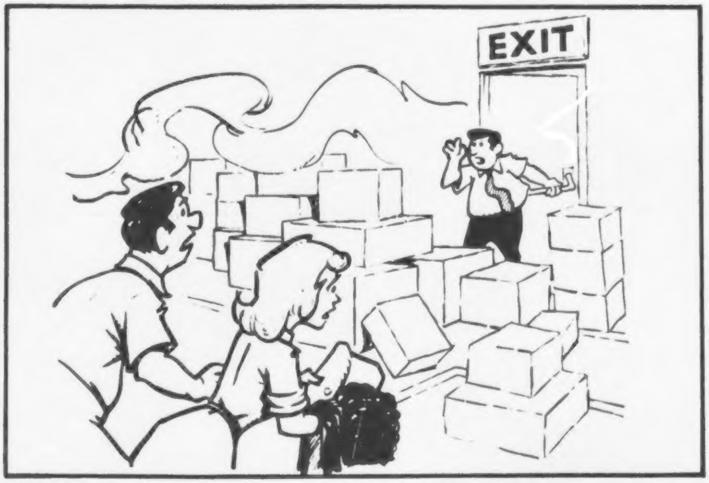
5. An alarm system, audible to all employees, must be provided on all automatic sprinkler installations.

   (Additional reference to the AUTOMATIC SPRINKLER SYSTEM OSHA 1910.159)

Cooking equipment (i.e., fat fryers, ranges, griddles, and broilers) which may be a source for the ignition of grease in the hood, grease removal device, or duct, shall be protected by approved extinguishing equipment.

The exit route must lead to a public way.

Areas around exit doors and passageways leading to and from the exits must be kept free of obstructions.



Exit access must be arranged so that it is unnecessary to travel through any highly-hazardous area in order to reach the nearest exit (unless the path of travel is effectively shielded by suitable partitions or other barriers).

A door from a room to an exit or to a way of exit access must be of the side-hinged, swinging type. It must swing out in the direction of travel if 50 or more persons occupy the room or if it is an exit from a highly-hazardous area.

Exits must be readily accessible at all times. Where exits are not immediately accessible from an open area, every occupant of that area must have access to two exits by separate paths. These paths must be through safe passageways, aisles, or corridors which lead directly to the exits.

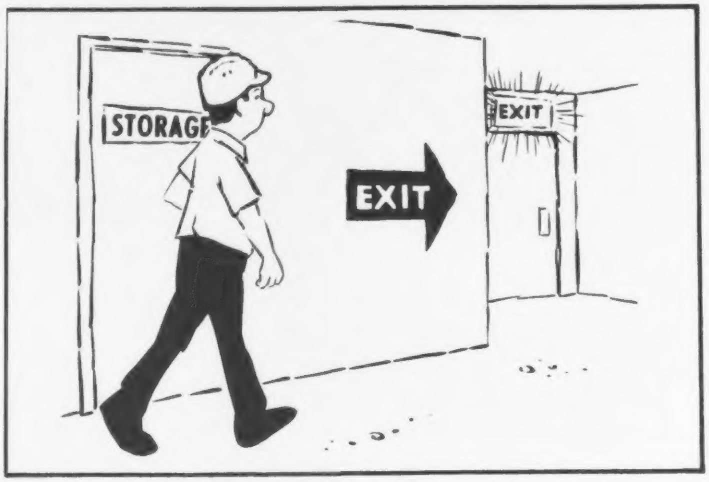
No lock, hasp, padlock, chain, bar, slide bolt, or locking device may be placed on a door required to have panic hardware (crash bar) while the building is occupied. Classrooms (under 100 capacity) shall have hardware of freewheeling type and no other locking device. This freehweeling--one hand operation shall release all locks and latches (with no special knowledge even in darkness), permitting egress from classrooms or other areas to exterior or exit corridors.

EXIT MARKINGS

Every exit must have the word "EXIT" in plain, legible letters not less than six (6) inches high, with the strokes of the letters not less that 3/4 inch wide.

The visibility of the sign must not be impaired by decorations, furnishings, or other signs.

Doors, passageways, or stairways which are neither exits nor ways to an exit, but may be mistaken for an exit, must be clearly marked "NOT AN EXIT" or have a sign indicating their actual use; e.g., "STORAGE ROOM" or "TO BASEMENT".



In areas where the direction to the nearest exit may not be apparent, an exit sign with a directional arrow must be used.

Exit signs must be illuminated by a reliable light source if the building is occupied at night, or if normal lighting levels are reduced at times during working hours.

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

National Fire Protection Association, Life Safety Code, 1973

National Association Of Fire Equipment Distributors

NIOSH - U.S. Department HEW

OSHA - U.S. Department Labor

Utah State Board of Education - Industrial Education Safety Curriculum Guide, 1974

U.S. Department of Labor, "Fire Protection for the Safety Man," Safety in Industry, Bulletin 232.

BOILER ROOMS

BOILER SAFETY INSPECTION

The boiler inspector, whether he/she is employed by the state, a municipality, or an insurance company, should be well-educated and well-informed on the natural and neglectful causes of the defects and deterioration of boilers. The inspector should be conscientious and extremely careful of his/her own observations. He/she should also take sufficient time to make the examinations thorough in every way, taking no one's statement as final concerning conditions he/ she has not observed.

The inspector should make a general observation of the condition of the boiler room and equipment. He/she should weigh carefully the conditions of any defects in order to determine the relation to, or influence upon, the safety of the boiler.

Refer to the current State of Kansas Department of Human Resources Boiler Inspection Act and Operating Instructions, Division of Boiler Inspection.

HEATING BOILERS

THE LOW PRESSURE STEAM HEATING BOILER is a closed vessel in which water is heated for the purpose of supplying steam, not exceeding 15 pounds per square inch.

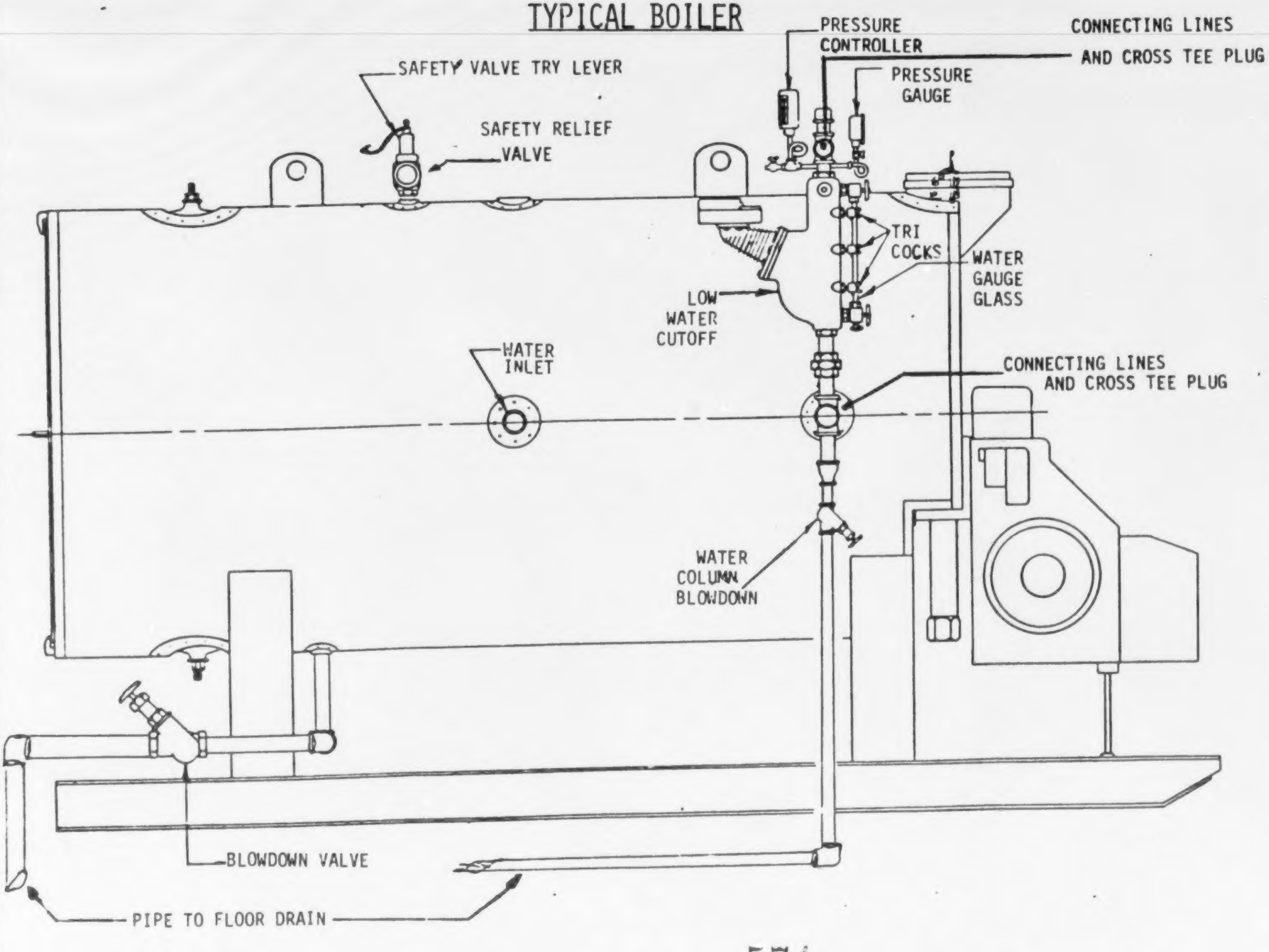
THE LOW PRESSURE HOT WATER HEATING BOILER is a closed vessel in which water is heated for the purpose of supplying heat at pressures not exceeding 160 pounds per square inch and a temperature not exceeding 250 degrees F.

SAFETY CONTROLS (WATER SIDE)

SAFETY VALVE TRY LEVER-- A safety check should be made every thirty (30) days that the boiler is in operation. After any period of inactivity, the following try lever test should be performed:

1. Operate the boiler with the minimum five pound gauge pressure.
2. Lift the try lever on the safety relief valve to the wide open position.
3. Allow the valve to discharge for five to ten seconds.

TYPICAL BOILER


PRESSURE CONTROLLER
CONNECTING LINES AND CROSS TEE PLUG
SAFETY VALVE TRY LEVER
PRESSURE GAUGE
SAFETY RELIEF VALVE
TRI COCKS
WATER GAUGE GLASS
LOW WATER CUTOFF
WATER INLET
CONNECTING LINES AND CROSS TEE PLUG
WATER COLUMN BLOWDOWN
BLOWDOWN VALVE
PIPE TO FLOOR DRAIN

4. Release the try lever and allow the valve to fully close.

5. Watch for valve leaks. If a leak is observed, pull the try lever open and closed several times, using a snap action to allow the disc to seat properly.

6. Repair or replace the valve if it continues to leak. This must be done by an authorized manufacturer's representative.

7. Do not attempt to disassemble or readjust the valve.

8. Never plug off the discharge of any safety valve.

9. Have a pull chain attached to the try lever of the valve to facilitate the test and allow it to be done in a safe manner from the floor.

10. Enter the date of the test into a boiler operator's log form. This record should be filed as a valuable source of information.

LOW WATER FUEL CUT-OFF--The type of boiler accident known as low water accident occurs if fuel continues to burn in the boiler when the boiler water level falls below the minimum safe point of operation. From a frequency point of view, it exceeds all other types of boiler accidents. Neglect, or failure of the human element, is by far the most frequent cause of a low water condition. The most frequent cause of a low water condition is neglect, or the human element of failing (1) to provide proper maintenance, (2) to test, (3) to inspect, or (4) to educate operation personnel.

SAFE OPERATION OF BOILER EQUIPMENT

Certain attachments are likely to collect deposits that must be removed periodically and cleaned. The following should be done:

1. Connect the lines for the water columns.

2. Dismantle the low-water float chamber.

3. Remove the clean-out plugs in the connecting lines.

These should be left open if an internal inspection of the boiler is scheduled during the idle season.

QUICK DRAIN TEST - STEAM BOILERS

The quick drain test for safety and equipment operation is applicable to the low water fuel cutoff and alarm devices having actuating elements (float and electrodes) located in a drainable chamber external to the boiler shell.

SCHOOL ____________________ BOILER NO. ____________

SAFETY CHECK LOG

RECORD TEST ON DAY INDICATED

(Instructions are Printed Below)

SCHOOL YEAR ____________ CUSTODIAN ____________

MONTH	Steam Boiler only LOW WATER CUT OFF MONDAY TESTED FRIDAY EACH WEEK					Steam Boiler only SAFETY RELIEF VALVE TESTED 1ST OF EACH MONTH	ALL AIR COMPRESSORS Drain water out of Tank and Filter MONDAY ______ FRIDAY EACH WEEK				
	1	2	3	4	5		1	2	3	4	5
JULY	M F						M F				
AUG.	M F						M F				
SEPT	M F						M F				
OCT.	M F						M F				
NOV.	M F						M F				
DEC	M F						M F				
JAN	M F						M F				
FEB	M F						M F				
MAR.	M F						M F				
APR	M F						M F				
MAY.	M F						M F				
JUNE	M F						M F				

With steam pressure on the boiler, open the valve quickly to drain the float chamber while the burner flame is on

This should turn off the burner flame.

Close the valve quickly. The burner flame will cycle on.

With steam pressure on the boiler, pull the lever chain to its full open position.

The relief valve should discharge steam.

Release the lever so as to allow the valve to snap closed.

Open the drain valve and drain water from the tank.

Close the drain valve when dry air comes from the tank.

The test consists of blowing down the chamber and turning the water column blow-down valve to "open" at the time when the burner flame is on and the boiler is under pressure. If the device is functional, it should cause the burner flame to shut off (the boiler operator must see that the flame is shut off). It will also flush the low water cutoff chamber and connections of accumulated sediment. Where dual cutoffs are installed, each device should be tested independently of the others.

The gauge glass should be closely watched, and the water level noted at the moment of the cut off of the burner flame (at the correct pre-marked water level).

If the device fails to function and does not turn off the flame at the proper level, close the water column blow-down valve immediately and restore the water level to normal. The boiler must not be operated until the cause of the malfunction has been corrected.

WATER TREATMENT PROBLEMS

CORROSION, WATERSIDE OF THE BOILER--Raw water, as received from city mains or wells, has impurities. These impurities include dissolved gases such as oxygen and carbon dioxide. They start corrosion inside the boiler system. This can be a general overall corrosion or localized pitting or cracking in stressed metal. High temperatures accelerate these reactions. If uncorrected, serious pitting can result, with the possible rupture of the boiler and tubes.

NOTE: Rusty water in the boiler glass gauge is a sign of corrosion in the heating system or in the boiler itself.

SCALE DEPOSITS WATERSIDE-- Raw water also contains dissolved salts where the water is hard. These are mainly calcium and magnesium compounds. Under boiler operating conditions, these salts come out of solution and form a scale on the hot boiler metal. This scale forms an insulating barrier on the boiler tubes and metals. The result is overheating and failure of the boiler metals.

NOTE: The problem should be reviewed with a reputable water treatment company. These companies furnish a service and chemicals for water treatment. They are in a position to make recommendations based on local water conditions. Test kits should be furnished for day-to-day analysis, and the results recorded.

Safety with chemicals should always be observed. One must make sure that the boiler compounds used do not violate any local ordinances with respect to the safe disposal of blow-downs, draining, and boiler-washing maintenance personnel.

COMBUSTION AIR

Combustion is a chemical process which results in the rapid release of energy in the form of heat. When a fuel burns, the chemical reactions between the combustible components in the fuel being used, and the sufficient mixture of oxygen in the air, result in a complete, efficient, and safe burning.

Properly-designed permanent facilities to supply a sufficient amount of outside air shall be provided. These operations should be followed:

1. Never close off or restrict the combustion air supply to any fuel-burning equipment.
2. Perform an annual cleaning maintenance on all combustion air supply grilles and screens.
3. Perform an annual cleaning on boiler burners and/or the primary air mixture equipment.

HOUSEKEEPING

All places of employment, passageways, storerooms, and service rooms shall be kept clean and orderly and in sanitary condition. (OSHA)

STAIRS

Standard railings or standard handrails are required on every flight of stairs having four (4) or more risers. (OSHA)

MACHINE GUARDING

AIR COMPRESSOR -- Refer to Section VI.

DIRECT DRIVE EQUIPMENT (EXAMPLE: RETURN PUMPS AND CIRCULATING PUMPS)-- Horizontal shafting, all exposed parts of horizontal shafting seven (7) feet or less from the floor or platform (except runways used exclusively for oiling or running adjustments) shall be guarded by a stationary casing enclosing the shafting completely or by a trough enclosing the sides and top or sides and bottom of the shafting as the location requires. (OSHA)

PULLEY BELT DRIVES--Pulleys and belts which are seven (7) feet or less from the floor shall be guarded. Materials that can be used are: expanded metal, perforated or solid sheet metal, wire mesh on a frame of angle iron, or iron pipe securely fastened to the floor or to the frame of the machine. All metal should be free from burrs and sharp edges. Expanded metal, sheet or perforated metal, and wire mesh shall be securely fastened to the frame. (OSHA)

STORAGE

BOILER ROOMS SHOULD NOT BE USED AS STORAGE ROOMS--The storage of flammables (boxes, rags, paper supplies, sawdust, custodial supplies, paints, thinners, etc.) should be done elsewhere. Flammable liquids should be stored in OSHA approved storage cabinets. These cabinets should not be located in the boiler room.

OCCUPANCY--The boiler room is for authorized personnel only (engineer, custodian). Boiler rooms and mechanical rooms should not be used as lounges. Interior boiler room doors are fire-rated doors and shall remain closed at all times.

CHLORINE

WARNING SIGN

This sign shall be affixed in a readily visible location at or near entrances to the areas in which chlorine is present in containers or systems. The sign shall be printed in English and in the predominant language of nonEnglish-speaking workers. All employees shall be trained and informed of the hazardous areas, with special instructions given to illiterate workers.

CAUTION
CHLORINE HAZARD AREA
UNAUTHORIZED PERSONS KEEP OUT
CAUSES BURNS, SEVERE EYE HAZARD
MAY BE FATAL IF INHALED

Protective Masks for Chlorine Located at ____________________
Specific Location

All chlorine piping systems shall be plainly marked for positive identification in accordance with American National Standards, A.13.1-1975. Associated vessels and critical shut-off valves shall be conspicuously labeled. Chlorine containers in use shall be plainly marked "in use" to distinguish them from those not in use. No container shall ever be presumed to be empty and therefore nonhazardous.

PERSONAL PROTECTION

PROTECTIVE CLOTHING--Personnel working with, or exposed to, liquid or gaseous chlorine containers or systems where chlorine contact with the eyes can occur shall have eye protection. Unless the eye protection comes from a respirator hood or facepiece, chemical goggles and face shield shall be worn. Additionally, impervious gloves shall be worn by persons connecting or disconnecting cylinders of chlorine. All protective clothing and equipment shall be supplied by the employer and maintained in a clean, sanitary, and usable condition.

RESPIRATORS--The employer shall ensure that no worker is overexposed to chlorine because of improper respirator selection, fit, use, or maintenance. A respiratory protection program meeting the requirements of 29 CFR 1910.134 shall be followed.

The employer shall provide respirators in accordance with the "Respirator Selection Guide" in this unit, and shall ensure that the employee uses the respirator provided. Employees shall be instructed on the use of respirators assigned to them and how to test for leakage.

Each indoor area required to be posted shall have emergency respiratory protective devices readily available. They should be in a nearby location which does not require entry into a contaminated atmosphere for access. Certain outdoor locations may be exempt from this requirement; depending upon such factors as chlorine capacity, accessibility to facility, nearness to other occupied locations and ease of evacuation.

Respirators specified for use in an atmosphere of higher concentration of chlorine may be used in atmospheres of lower concentration.

Canisters shall be discarded after use, or whenever an order or taste is detected, and then replaced with fresh canisters. The unused canister shall be discarded and replaced when the seal is broken or when the shelf life recommended by the manufacturer ends.

RESPIRATOR SELECTION GUIDE

Chlorine Concentration		Respirator Type
Less than or equal to 25 ppm	(1)	Chemical cartridge respirator with full facepiece and cartrige(s) and filter(s) providing protection against chlorine
	(2)	Full-face mask, chest or back-mounted type; with industrial-size chlorine canister
	(3)	Any supplied-air respirator with a full facepiece, hood, or helmet with shroud
	(4)	Any self-contained breathing apparatus with a full facepiece
Greater than 25 ppm and emergencies	(1)	Self-contained breathing apparatus with full facepiece; pressure-demand or other positive pressure type
	(2)	Combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode; and an auxiliary self-contained breathing apparatus, pressure-demand or other positive pressure type
Evacuation or escape	(1)	Self-contained breathing apparatus with full facepiece
	(2)	Any gas mask with industrial-size chlorine canister.

STORAGE

Chlorine shall be stored in adequately ventilated, unoccupied rooms or in an outdoor location shielded from the direct rays of the sun (unless the container is properly insulated and designed for unshaded outdoor storage). Indoor storage areas shall be cool and dry.

At least two exits, remote from each other and opening outward from the building, shall be provided for all chlorine storage rooms. Chlorine storage enclosures shall be provided with an inspection window to permit viewing of the interior without entry.

Chlorine storage enclosures shall be completely isolated from work areas. If separated from a work area by a common wall, all holes, ducts, doors, and pass throughs which could allow chlorine to enter other parts of the building shall be secured and sealed. Central cooling and heating ducts may not extend to chlorine storage areas, but such areas may be cooled by terminal ducts with a one-way flop or other appropriate valve to prevent the significant reflux of air from the storage area into the duct system. If an enclosed storage area is cooled in this way, the pressure within the enclosure shall be maintained slightly below the atmospheric pressure by forced exhaust to the outside of the area.

Containers shall be secured so they will not fall, upset, or roll. A chlorine container shall be protected from flame, heat corrosion, and mechanical damage. Containers of chlorine shall be used on a first-in, first-out basis.

Incompatible materials which may react violently with chlorine (i.e., hydrogen, ammonia, acetylene, fuel gasses, ether, turpentine, and most hydrocarbons) may not be stored immediately adjacent to chlorine. The degree of separation required will be dictated by the quantities stored and the type of storage facility.

HANDLING

Areas that hold chlorine containers and systems shall be checked frequently for leaks. All new-made connection shall be checked for leaks immediately after the chlorine is admitted. Required repairs and adjustments shall be promptly made. No water shall be applied to the source of the leak.

Every precaution shall be taken to keep chlorine and its equipment free of moisture. Piping, valves, and containers shall be capped or closed when not in use to keep atmospheric moisture out of the system.

When moving chlorine containers, valve protection hoods shall be in place. New gaskets shall be used each time chlorine system connections are made.

No personnel shall work alone when chlorine is first admitted to a newly designed or installed system, or while repairing leaks.

Any odor of chlorine from a normally closed system shall be reported without delay to responsible supervisory personnel. (NIOSH)

ELECTRICAL REQUIREMENTS

(THE NATIONAL ELECTRICAL CODE (NEC)

MORE FIRES ARE CAUSED BY ELECTRICAL MALFUNCTION THAN ANY OTHER CAUSE. Standards pertaining to electrical equipment and its use in all industries have been cited as violations more frequently than any others.

The National Electrical Code (NFPA 70, ANSI C1-1971) has been adopted as a national consensus standard by OSHA. (Refer to INFORMATION SOURCES.) The purpose of the NEC is the practical safeguarding of people, buildings, and building contents from hazards arising due to the use of electricity. The code contains those basic minimum provisions considered necessary for safety. The electrician should be familiar with these requirements. Electrical work should be done by licensed and bonded personnel.

EXTENSION CORDS

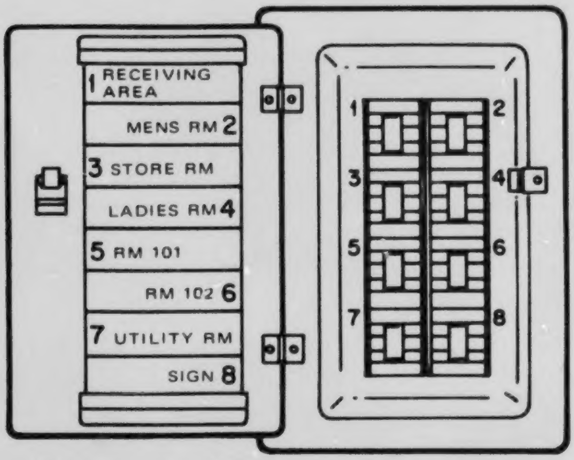
1. Extension cords should never be used as permanent wiring. They are designed for temporary usage.
2. Extension cords shall be a continuous length without splices or taps.
3. Extension cord plugs shall be fastened so that there is no pull on the joints or terminal screws.
4. Extension cords shall be replaced when the insulation deteriorates.
5. Extension cords may not run through holes in walls, ceilings, floors, doors, or windows.
6. Extension cords may not be attached to building surfaces.
7. The extension cord conductor size should be adequate to assure that overheating will not occur.
8. An extension cord (two-conductor) should never be used from a three-wire outlet source to a piece of equipment requiring three-wire. This eliminates the grounding protection for the operator of the equipment.
9. The extension cord conductor size should never be less than AWG #14.

ELECTRICAL PANELS AND SWITCH GEAR

1. A minimum depth of clear working space in front of electrical equipment must be maintained at all times (four feet is suggested).

2. Where there is electrical equipment operating over 600 volts, the doors should be kept locked and the keys given to a qualified person.

3. Each disconnecting means for motors and appliances must be legibly marked to indicate its purpose(unless its purpose is evident).



PROPER LABELING OF CIRCUIT BREAKERS

SWIMMING POOL

1. Electrical outlets and equipment shall be at a minimum of ten feet from the water's edge.

2. Equipment electrical cords shall be #12 AWG wire and shall not exceed three feet in length.

3. All electrical equipment used within a swimming pool area shall be approved for such usage.

4. Pool electrical receptacles shall have ground fault circuit interrupters for personnel protection.

5. All underwater audio and lighting fixtures must be Underwriters' Laboratories (UL) listed.

WHIRLPOOL BATH

1. Receptacles shall have ground fault circuit interrupters for personnel protection.

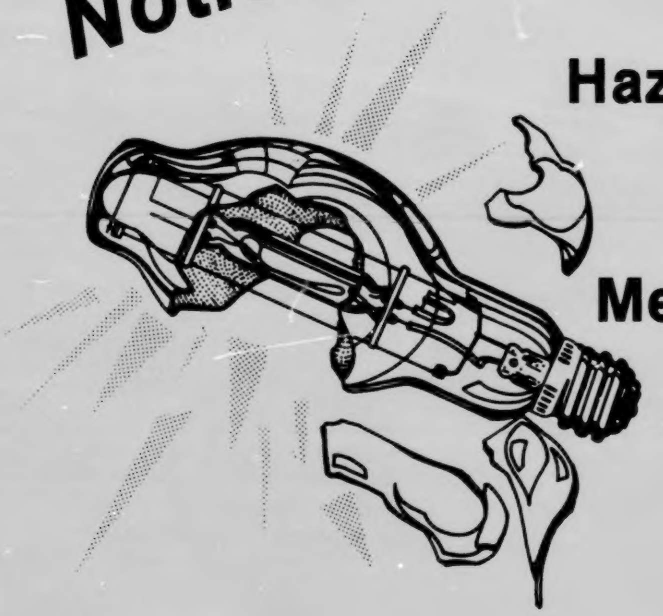
2. Switch gear shall be out of personnel reach in the whirlpool bath.

LIGHTING LEVELS--Refer to Luminating Engineering Society, 345 East 47th Street, New York, New York, 10017

MAINTENANCE--Electrical outlets, switches, and cover plates must be maintained to assure their safe operation. (NIOSH)

Notice of Alert

Hazards from Broken Mercury Vapor and Metal Halide Lamps



In November 1977 the Food and Drug Administration issued a Notice of Alert concerning possible hazards associated with broken mercury vapor lamps. The notice advised the use of lamps with an automatic shut-off device, or shielding, where people might be exposed to dangerous ultraviolet radiation if the outer globe of the lamp is broken. Reports of injuries continue to be reported to the Bureau of Radiological Health. We are concerned that the earlier alert may not have reached the individuals who could ensure that precautions are taken. PLEASE COMMUNICATE THIS INFORMATION TO OTHER PERSONS WHO MIGHT BE INTERESTED OR AFFECTED BY THIS HAZARD.

As is indicated in the earlier Notice of Alert, high intensity mercury vapor and metal halide lamps can be dangerous if they continue to operate when the outer globe of the lamp is broken, punctured, or missing. A broken outer globe allows the lamp to emit intense ultraviolet radiation. Persons exposed to excessive amounts of ultraviolet radiation can suffer severe skin burns and painful, potentially permanent eye damage. Injuries occurring in stores, sports arenas, warehouses, outdoor fairgrounds, and school gymnasiums have been, and continue to be, reported to the Bureau of Radiological Health. The following updated material has been prepared to advise you of the new regulation and to help you prevent injuries in your facility.

On September 7, 1979, the FDA issued a Performance Standard for High Intensity Mercury Vapor Discharge Lamps, including "mercury vapor" and "metal halide" lamps. Except for one small part, the Standard went into effect March 7, 1980. The Performance Standard issued by FDA allows the manufacture of two types of mercury vapor lamps. One type has a self-extinguishing device that will shut the lamp off within 15 minutes after the outer globe is broken. These lamps are marked "T."

This label will appear on the packaging of self-extinguishing mercury vapor and metal halide lamps:

> *"This lamp should self-extinguish within 15 minutes after the outer envelope is broken or punctured. If such damage occurs, TURN OFF AND REMOVE LAMP to avoid possible injury from hazardous shortwave ultraviolet radiation."*

NOTE THAT A "SELF-EXTINGUISHING" LAMP MAY TAKE AS LONG AS 15 MINUTES TO TURN OFF AFTER THE OUTER BULB HAS BEEN BROKEN. Therefore, if a lamp breaks, even if it is self-extinguishing, people should leave the area immediately.

The second type of mercury vapor lamp does not have a self-extinguishing device incorporated into the lamp. This type of lamp is to be used only in a fixture with a glass or plastic shield that will absorb the hazardous ultraviolet radiation, or in areas where people will not be exposed to ultraviolet radiation if the outer globe is broken. These lamps are marked "R."

This label must appear on the packaging and advertising for non-self-extinguishing mercury vapor and metal halide lamps:

> *"WARNING: This lamp can cause serious skin burns and eye inflammation from shortwave ultraviolet radiation if the outer envelope of the lamp is broken or punctured. Do not use where people will remain for more than a few minutes unless adequate shielding or other safety precautions are used. Lamps that will automatically extinguish when the outer envelope is broken or punctured are commercially available."*

If you plan to install mercury vapor or metal halide lamps in areas ordinarily occupied by people:

1. USE BULBS THAT HAVE SELF-EXTINGUISHING MECHANISMS. (A list of manufacturers presently marketing these bulbs is attached.)

OR

2. USE TOTALY ENCLOSED LIGHTING FIXTURES WITH PROTECTIVE SHIELDS THAT PROTECT THE LAMP FROM DAMAGE AND ABSORB ULTRAVIOLET RADIATION. (Shielding is available for most fixtures.)

PLEASE DISTRIBUTE COPIES OF THE ATTACHED FLYER AND FACT SHEET TO MAINTENANCE AND OTHER PERSONNEL INVOLVED IN THE USE OF FACILITIES EQUIPPED WITH SUCH LAMPS. An attempt should be made to ensure that they understand the need for concern. Periodic checks for broken or missing outer bulbs

--with the lamps turned off--should be a part of the regular maintenance program. People occupying areas lighted by high intensity discharge lamps should be advised to:

1. be alert for signs of damaged bulbs, such as broken glass on the floor;
2. alert the proper personnel to turn off a lamp with a broken outer bulb immediately;
3. vacate the area lighted by a lamp with a broken outer bulb;
4. be aware of the symptoms of injury from ultraviolet radiation exposure (i.e., skin burns and eye irritation) so that anybody who is injured can tell a doctor that the injury may be associated with exposure to ultraviolet radiation, and;
5. report any injuries to the State health department and to the Food and Drug Administration's Bureau of Radiological Health.

If you would like additional free copies of the flyer or Notice of Alert, write to:

Bureau of Radiological Health
Food and Drug Administration (HFX-28)
Rockville, Maryland 20857

Included is a list of questions that are frequently asked about possible radiation hazards from broken mercury vapor and metal halide lamps, along with our replies. If you have further questions or wish to comment concerning this matter, write to:

Bureau of Radiological Health (HFX-460)
Food and Drug Administration
Rockville, Maryland 20857

Fact Sheet on Mercury Vapor and Metal Halide Lamps

1. Q: To what kind of high intensity discharge lamps does the standard apply?

   A: The standard is intended to apply to lamps, including "mercury vapor" and "metal halide," that incorporate a high pressure arc discharge tube, with a fill consisting primarily of mercury, contained within an outer envelope and which is designed, intended, or promoted for illumination purposes. The standard does not apply to high pressure sodium lamps, fluorescent lamps nor to blacklights, because available information does not indicate a public health risk in the use of such products at this time.

2. Q: Who manufactures self-extinguishing lamps?

   A: Based upon information currently available to FDA, manufacturers of mercury vapor lamps with a self-extinguishing feature are listed in alphabetical order below. This listing does not imply an endorsement by FDA of products manufactured by these companies:

   1. Duro-Test Corporation
      North Bergen, New Jersey 07047

   2. General Electric Company
      Edison Park
      8499 Darrow Road
      Twinsburg, Ohio 44087

   3. GTE - Sylvania
      100 Endicott Street
      Danvers, Massachusetts 01923

   4. North American Philips Lighting Corp.
      Heightstown, New Jersey 08520

   5. Westinghouse Electric Corporation
      One Westinghouse Plaza
      Bloomfield, New Jersey 07003

   For further information concerning the lamps, please contact the companies at the above addresses.

3. Q: Must all high intensity lamps used in areas where people gather be self-extinguishing?

   A: No. As discussed in the Notice of Alert, a shield over the lamp and fixture (luminaire), in some cases, may prevent damage to mercury vapor lamps not equipped with a self-extinguishing feature, and thereby may preclude injuries. Such shields should protect against and also absorb ultraviolet radiation if the lamp were to break or become defective within the shielded fixture. This shielding alternative can be used in place of self-extinguishing lamps.

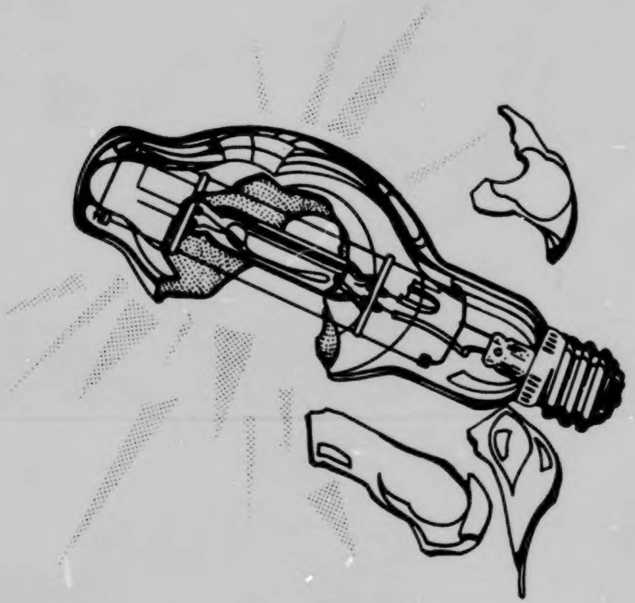
FDA is unable to provide specific data on available shields for each type of lamp or fixture (luminaires). For further information on shields for lamps of interest, we suggest you contact the supplier of the lamp or fixture (luminaire).

4. Q: What factors are important in determining the relative dangers associated with the use of these lamps?

A: The relative dangers posed by a broken mercury lamp vary with each application and depend upon a number of factors including the wattage of the lamp (the more wattage, the more dangerous it is if it is broken), the mounting height (the higher the lamp, the less danger), the type of luminaire used (a luminaire may reduce chances of breakage), and the likely duration of exposure (the longer the exposure, the more chance of injury). All these factors should be carefully considered in designing a lighting installation.

Based on the limited experience with lamp use and injury reports, it is suggested that as a general rule only self-extinguishing lamps (T types) or shielded non-self-extinguishing lamps (R types) be used in areas where people may remain for more than 15 minutes. Such areas include, but are not limited to, gymnasiums and other indoor areas and outdoor lighted areas where people tend to gather or linger such as building entrances, school parking lots, fairgrounds, sports areas, and certain residential streets. Injuries from broken mercury vapor lamps have been known to occur in some of these areas. Areas where unshielded "R" type lamps may be used safely include highways and other nonresidential roadways and indoor areas having controlled, limited access which are occupied for only short periods of time.

Caution should be used, however in applying the preceding guidance and a decision to use an unshielded "R" type lamp should be made only after carefully weighing all of the relevant factors. If there is any doubt about the type of lamp that should be used, then use a "T" type lamp or a shielded "R" type.



Broken Mercury Vapor and Metal Halide Lamps can be Dangerous

High intensity discharge lamps which continue to work after their outer bulbs are damaged give off hazardous ultraviolet radiation. This radiation is invisible, but can cause severe skin burns and eye damage. Extensive or repeated exposure could increase the risk of skin cancer.

- **CHECK THE LAMPS REGULARLY FOR MISSING, BROKEN OR PUNCTURED OUTER BULBS. This should be done with the lamps off.**
- **IF A LAMP IS BROKEN, TURN THE LAMP OFF IMMEDIATELY.**
- **REPLACE LAMPS ONLY WHEN THE LAMPS ARE OFF.**
- **PERSONS EXPOSED TO ULTRAVIOLET RADIATION FROM A DAMAGED LAMP SHOULD SEE A DOCTOR IF SYMPTOMS OF SKIN BURNS OR EYE IRRITATION OCCUR.**
- **REPORT INCIDENTS OF INJURIES TO YOUR STATE HEALTH DEPARTMENT AND TO THE FOOD AND DRUG ADMINISTRATION.**

For more information, write to: U.S. Dept. of Health and Human Services,
Food and Drug Administration, Bureau of Radiological Health,
Rockville, Maryland 20857

HHS Publication No. (FDA) 80-8135

1894F

MATERIAL HANDLING AND STORAGE (OSHA/NIOSH)

USE OF MECHANICAL EQUIPMENT

Where mechanical handling equipment is used, sufficient safe clearance shall be allowed for aisles, at loading docks, through doorways, and wherever turns or passage must be made. The aisles and passageways shall be kept clear and in good repair, with no obstructions across or in the aisles that would create a hazard. Permanent aisles and passageways shall be appropriately marked.

SECURE STORAGE

The storage of materials shall not create a hazard. Bags, containers, bundles, etc. stored in tiers shall be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding.

HOUSEKEEPING

Storage areas shall be kept free from the accumulation of materials that constitute a hazard from tripping, fire, explosion, or pest harborage. Vegetation control will be exercised, when necessary.

STORED MATERIALS

This material must not obstruct fire extinguishers, alarm boxes, sprinkling system controls, electrical switch boxes, emergency lighting, first aid equipment, or exits.

FLOOR LOADS

The floor load capacity is the maximum weight of stored supplies that can be safely supported by the floor. This capacity is expressed in pounds per square foot of storage space. When this information is not available, and floor load capacity is in doubt, one should consult a competent engineer to determine the maximum floor load capacity.

DOORS

Doors should be of sufficient height and width to readily accommodate the safe use of material handling equipment.

LAYOUT OF AISLES

Safe operations within the storage areas require considerable attention to the space layout for aisles. There must be enough operating space for handling and stacking materials safely.

Aisles should be planned to provide easy access to exits and to fire control equipment. They should be straight and clear of obstructions.

A clear space shall be maintained around fire protection equipment, and the location of such equipment shall be well marked. Obstructions such as columns and posts should be marked, preferably with diagonal black and yellow stripes.

FLOORS AND STAIRWAYS

Floors, stairways, and loading areas shall be kept clear of slipping and tripping hazards such as oil spills or splintered or damaged floors.

All drums shall be kept tightly sealed. If leakage occurs, the damaged container must be removed and any resultant fire or slipping hazard eliminated.

STORAGE RACKS

Storage racks shall be inspected periodically for cracks, weakness, or severe indentations resulting from collisions with lift trucks. Defective racks should be repaired or replaced. When barrels or drums are stored on end, sturdy platforms, such as wooden planks, should be placed between each level. When stacked on three sides, the barrel on the bottom row should be securely wedged on each end. Twenty gallon or smaller drums should be tied or bound together in groups for stability and for security from falling.

Cold Storage

Common hazards encountered in cold storage areas are frostbite, falls on icy surfaces, and skin contact with cold surfaces (which can cause the skin to freeze to the surface).

Sufficient exits must be provided for use in emergencies. Cold storage rooms shall be equipped with at least one door that can be opened from the inside.

Cylinder Storage

Oxygen and fuel gas cylinders stored inside buildings shall be located in a well-protected and well-ventilated dry location. They must be at least 20 feet from flammable or highly combustible materials and away from elevations, stairs, or gangways. They must not be stored in unventilated enclosures, such as lockers and cupboards. All cylinders must be kept away from radiators and other sources of heat.

A valved protection cap must be used if the cylinder is designed to accept a cap (except when the cylinder is in use or connected for use).

Stored oxygen cylinders must be kept separated from stored fuel gas cylinders, or from flammable or combustible materials (including oil and grease) by a minimum distance of 20 feet or by a noncombustible barrier at least five feet high and having a half hour fire resistance rating. Sheet metal partitions are not an acceptable method of separating cylinders.

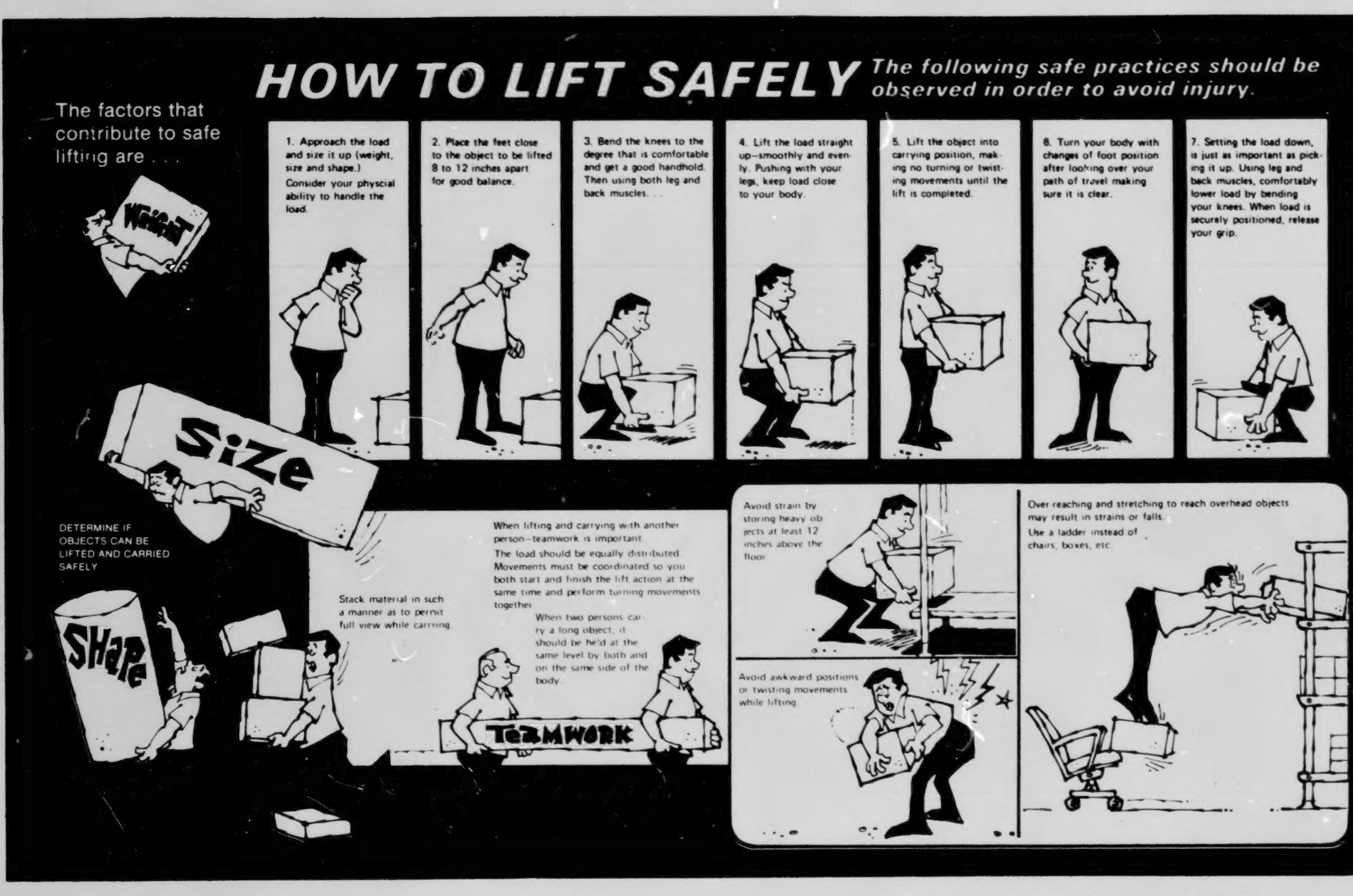
Storage of Oxygen and Fuel Gas Cylinders

All cylinders must be legibly marked to identify the contents.

To prevent toppling, no cylinder should be permitted to stand alone unless it is secured with a lashing or chain.

Empty cylinders shall be stored separately, but in the same manner as full cylinders. Cylinders must not be lifted by the valve protection cap.

"No Smoking" signs shall be posted, and smoking shall be prohibited in or around compressed gas storage sheds.



HOW TO LIFT SAFELY

The following safe practices should be observed in order to avoid injury.

The factors that contribute to safe lifting are . . .

DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY

1. Approach the load and size it up (weight, size and shape.) Consider your physcial ability to handle the load.

2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.

3. Bend the knees to the degree that is comfortable and get a good handhold. Then using both leg and back muscles. . .

4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body.

5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.

6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.

7. Setting the load down, is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.

Stack material in such a manner as to permit full view while carrying

When lifting and carrying with another person—teamwork is important

The load should be equally distributed Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together

When two persons carry a long object, it should be held at the same level by both and on the same side of the body.

Avoid strain by storing heavy objects at least 12 inches above the floor

Avoid awkward positions or twisting movements while lifting

Over-reaching and stretching to reach overhead objects may result in strains or falls.

Use a ladder instead of chairs, boxes, etc

MANUAL HANDLING PROCEDURES

Manual handling is relatively safe if the proper lifting and carry positions are used. The failure of personnel to use mechanical lifting devices for handling heavy loads is one of the major causes of material handling accidents and injuries. Hernias, back strains, crushed hands and feet, broken bones, and severe lacerations are the more common results of poor manual handling practices. One of the most important factors in manual handling safety practices is the adequate training of personnel. Employees must receive thorough instructions in both safe lifting and carrying procedures and in the personal protective equipment to be used. Adequate supervision is necessary to ensure that safe practices are being observed at all times. Jewelry, rings, and loose clothing must not be worn during handling operations.

MECHANICAL HANDLING AND LIFTING DEVICES

Improper or unsafe use of equipment and vehicles accounts for a major portion of all mechanical handling accidents. Defective and damaged equipment is a potential source of accidents and fire hazards (if gasoline-powered vehicles and handling equipment is used). The two primary hazards inherent in the operation of lift trucks are collision or overturning of the truck, and movement or collapse of bridge plates, dockboards, or other trucks or trailers. Additional accidents occur when cartons and boxes fall from lifting vehicles.

HYDRAULIC LIFT TRUCKS AND HAND TRUCKS

A hydraulic lift truck that leaks fluid must be taken out of service until it has been repaired. The leaking can cause a load to settle after a load has been raised, and it creates obvious slipping hazards.

The operators of hand trucks shall wear gloves and safety shoes. Knuckle guards installed on handles will prevent jamming the hands into obstructions.

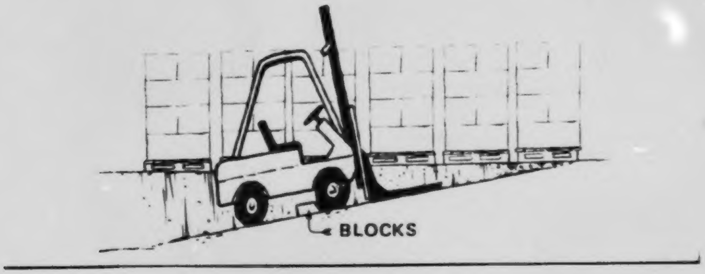
POWERED INDUSTRIAL TRUCKS

The operation of any type of powered industrial truck in an area where flammable or combustible materials (dust, vapors, etc.) are airborne can provide the spark or hot surface (e.g., muffler on a non-electric truck) necessary for a fire or explosion. For this reason, OSHA regulations classify all truck operating areas into four types. Three types are those areas in which the various kinds and degrees of fire hazards exist. The fourth type includes all other areas. Truck types allowed for each of these four categories are listed in the code of Federal Regulations, 29 CFR 1910. 178 (C) (2) Table N-1. Interpretative information is available by contacting the nearest OSHA or NIOSH office.

Methods must be developed and used to effectively train operators in the safe operation of powered industrial trucks, and only trained and authorized employees may operate those trucks. OSHA has prepared materials for use in training programs for truck operators. Other material is available from truck distributors, State Occupational Safety and Health Agencies, and the National Safety Council. The following guidelines pertain to powered industrial trucks and their operations:

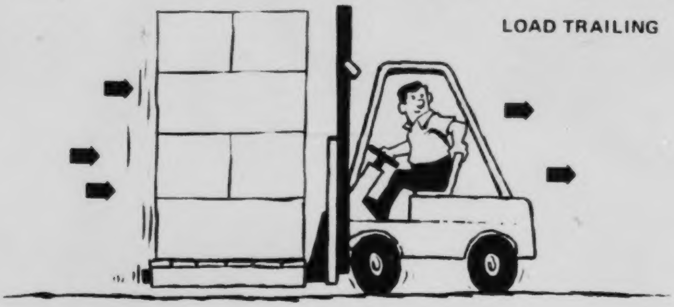
1. High lift rider trucks must be fitted with an overhead guard and load backrest extension to protect the operator from falling objects.

2. When a powered industrial truck is left unattended (operator 25 feet or more away or the truck not in view), the forks must be fully lowered, the control lever positioned in neutral, the power shut off, and the brakes set. The wheels must be blocked if the truck is parked on an incline.



3. Industrial trucks must be examined daily, before being placed in service, for any conditions adversely affecting their safety. If the truck is used around the clock, it must be inspected after each shift.

4. If the load being carried obstructs the operator's forward view, he/she is required to travel with the load trailing.



5. When loading or unloading from trucks, trailers, or railroad cars, the truck, trailer or railroad car must be secured by setting the brakes and placing wheel chocks under the rear wheels. Portable dock boards must be secured in position with devices which will prevent their slipping during loading and unloading.

6. Loaded vehicles must not be put in motion until the load is properly stacked and secured.

7. When it is necessary to park inside warehouses, the vehicles must be parked only in approved, authorized areas.

8. Drivers must be particularly careful when approaching doorways, aisle crossings, and other intersections. They should sound a warning by using a horn or bell signal.

9. Drip pans should be placed under vehicles that are parked for long periods of time inside buildings.

10. Operators must keep their arms, legs, and other parts of their bodies within the dimensions of the operator's compartment.

11. The load must be carried as near the floor as possible.

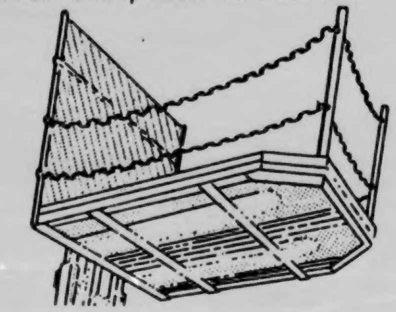
12. Forktruck drivers must not stack empty pallets higher than eye level.

13. Unless the vehicle is equipped with an adequate passenger seat, and authorization given, no person other than the driver shall be allowed to ride on any material handling vehicle.

14. The operator must not stunt drive or indulge in horseplay.

15. Only approved work platforms shall be used to lift a workman to the top of stacked material.

16. Personnel must not be transported from one place to another on a work platform.



Forklift Checklist (NIOSH Publications No. 78-195)

The following checklist should be used as a general guide for the safe and efficient operation of forklifts used for materials handling:

1. Stay within the rated capacity.
2. Lift with the mast vertical or tilted slightly back, never forward.
3. Never travel with the load lifted high.
4. Do not raise or lower the load while traveling.
5. Watch the rear-end swing.
6. Proceed slowly and cautiously around corners.
7. Watch blind corners-signal with the horn.
8. Use low gear when traveling down ramps.
9. Avoid sudden stops.
10. Do not descend ramps with the load in front.
11. Watch overhead clearances.
12. Drive backwards with bulky loads. This gives better vision.
13. Watch floor strengths.
14. Use care in high stacking-watch for falling stock.
15. Be careful when handling long lengths of bar stock, lumber, etc., and watch the swing. If necessary, use a walking guide.
16. Keep the load against the carriage, except when technical order procedures provide otherwise.
17. Keep the load balanced laterally.
18. Spread the forks according to the load width.
19. Lower heavy loads slowly; stop them slowly.
20. Keep clear of the loading dock edges.

21. Check the bridge plates between the loading docks, trucks, and cars for sufficient width, strength, and security.

22. When loading or unloading highway trucks or trailers:

    A. Be sure the vehicle's brakes are set or the wheels chocked, or both.

    B. Support the vehicle body with jacks or braces if the springs are weak.

23. Never tilt an elevated load forward, except to place it on a stock pile.

24. Securely chain all objects of irregular shape to the forklift frame before raising, lowering, or moving them. Large irregularly-shaped objects should normally be placed on pallets for stability before being raised or transported.

25. Permit only the operator on the forklift.

26. Check the foot and hand brakes for effective operation.

27. Have an adequate fire extinguisher available on the forklift.

28. Remove ice or snow from the work area before loading or unloading; or make the area safe through the use of appropriate materials.

29. When the forklift is not in use, place it in gear, lower the forks, turn off the engine, set the hand brake, and choch the wheels. Never leave the vehicle unattended with the engine running.

PORTABLE SCAFFOLDS

OSHA RECOMMENDATIONS

1. The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.

2. Guardrails and toeboards shall be installed on all open sides, and the ends of platforms more than ten feet above the ground or floor.

3. Scaffolds and their components shall be capable of supporting, without failure, at least four times the maximum intended load.

4. Scaffolds shall be maintained in a safe condition. Scaffolds shall not be altered or moved horizontally while they are in use or occupied.

5. Any scaffold that is damaged or weakened shall be immediately repaired and shall not be used until the repairs have been completed.

6. Scaffolds shall not be loaded in excess of the working load for which they are intended.

7. Tools, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard.

8. Frames and accessories for scaffolds shall be maintained in good repair. Every defect, unsafe condition, or noncompliance with this section shall be immediately corrected before there is any further use of the scaffold. Broken, bent, excessively rusted, altered, or otherwise structurally damaged frames or accessories shall not be used.

9. Periodic inspections shall be made of all welded frames and accessories. Any maintenance (including painting) or minor corrections authorized by the manufacturer shall be made before further use.

FIXED LADDERS (OSHA/NIOSH)

DESIGN REQUIREMENTS

1. All fixed ladders shall be designed to withstand a single concentrated load of at least 200 lbs.

2. The weight of the ladder and the attached appurtenances, together with the live load, shall be considered in the design of the rails and fastenings.

SPECIFIC FEATURES

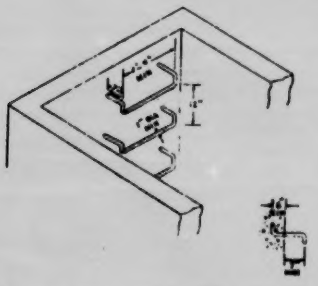
1. Rungs and cleats shall have a minimum diameter of three fourths of an inch for metal ladders, and a minimum diameter of one and one eighth (1-1/8) inches for wood ladders.

2. The distance between rungs, cleats, and stops shall not exceed 12 inches and shall be uniform throughout the length of the ladder.

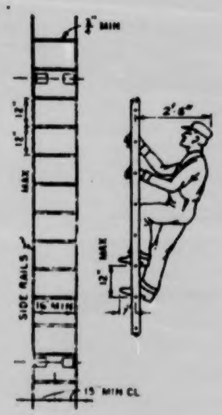
3. The minimum clear length of rungs or cleats shall be 16 inches.

4. Rungs, cleats, and steps shall be free of splinters, sharp edges, burrs, or projections which may be a hazard.

5. The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end.



SUGGESTED DESIGN FOR RUNGS ON INDIVIDUAL RUNG LADDERS



RAIL LADDER WITH BAR STEEL RAILS AND ROUND STEEL RUNGS

ADDITIONAL FEATURES

1. Side rails which might be used as a climbing aid shall be of such cross sections as to afford adequate gripping surface without sharp edges, splinter, or burrs.

2. All splices shall meet design requirements. All splices and connections shall have a smooth transition with the original members and have no sharp or extensive projections.

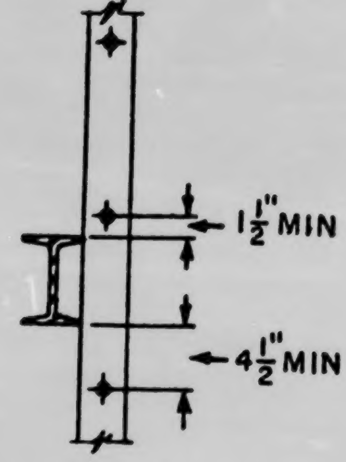
3. Metal ladders must be painted or otherwise treated, to resist deterioration when the location demands it. When used under conditions where decay may occur, wood ladders shall be treated with a nonirritating preservative, and the details shall be such as to prevent or minimize the accumulation of water on the wood parts.

CLEARANCE

1. On fixed ladders, the perpendicular distance from the centerline of the rungs to the nearest permanent object on the climbing side of the ladder shall be 36 inches for a pitch of 76 degrees and 30 inches for a pitch of 90 degrees--with minimum clearance for intermediate pitches varying between these two limits in proportion to the slope.

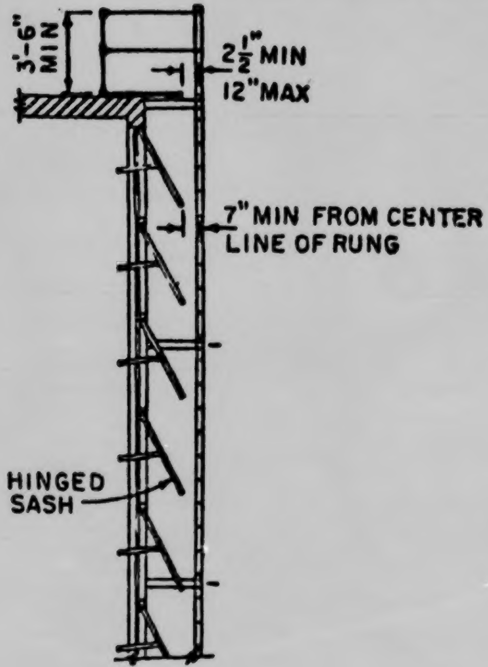
2. A clear width of at least 15 inches shall be provided in each direction from the centerline of the ladder, in the climbing space; except when cages or wells are necessary.

3. The distance from the centerline of the rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than seven inches. When unavoidable obstructions are encountered, the minimum clearances shall be provided.



CLEARANCE FOR UNAVOIDABLE OBSTRUCTION AT REAR OF FIXED LADDER

4. The step-across distance from the nearest edge of the ladder to the nearest edge of the equipment or structure shall be not more than 12 inches, or less than two and one half(2 1/2) inches.



LADDER FAR FROM WALL

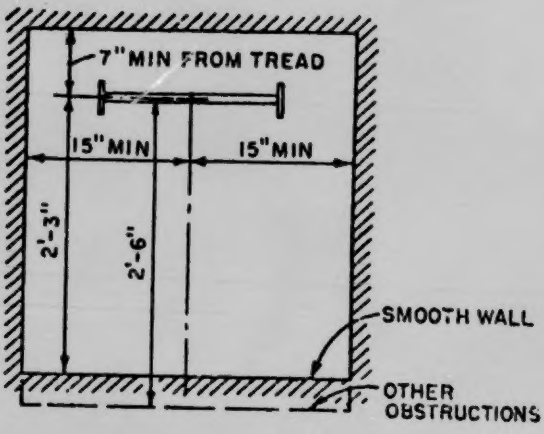
CAGES OR WELLS

1. Cages or wells shall be provided on ladders of more than 20 feet to a maximum unbroken length of 30 feet.

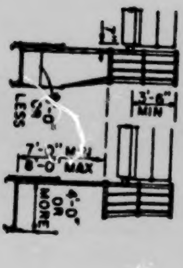
2. Cages shall extend a minimum of 42 inches above the top of the landing unless other acceptable protection is provided.

3. Cages shall extend down the ladder to a point not less than seven feet nor more than eight feet, above the base of the ladder; with the bottom flared not less than four inches. Or a portion of the cage opposite the ladder shall be carried to the base.

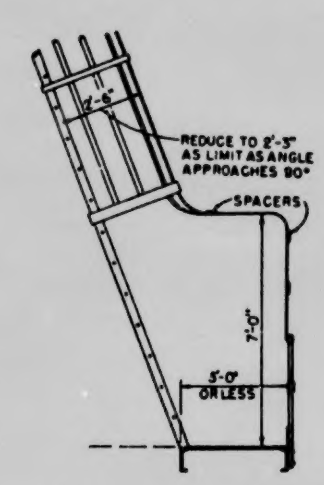
4. Ladder wells shall have a clear width of at least 15 inches, measured each way from the centerline of the ladder. Smooth-walled wells shall be a minimum of 27 inches from the centerline of the rungs to the well wall on the climbing side of the ladder. Where other obstructions on the climbing side of the ladder exist, there shall be a minimum of 30 inches from the centerline of the rungs.


7" MIN FROM TREAD
15" MIN
15" MIN
2'-3"
2'-6"
SMOOTH WALL
OTHER OBSTRUCTIONS

CLEARANCE DIAGRAM FOR FIXED LADDER IN WELL

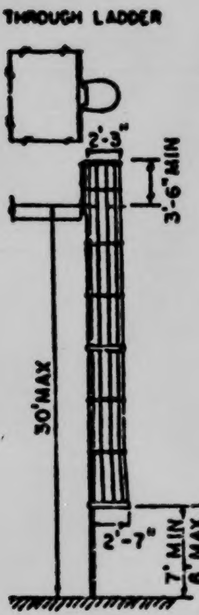

8'-0" OR LESS
3'-6" MIN
7'-0" MIN
8'-0" MAX
4'-0" OR MORE

SHORT LADDERS AT
ELEVATED LOCATION

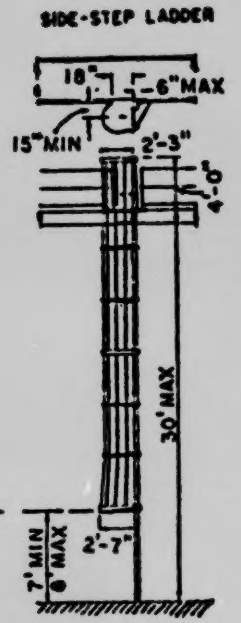

2'-6"
REDUCE TO 2'-3" AS LIMIT AS ANGLE APPROACHES 90°
SPACERS
7'-0"
5'-0" OR LESS

INCLINED LADDER
AT ELEVATED LOCATION
(FOR SPECIAL HAZARD ONLY)

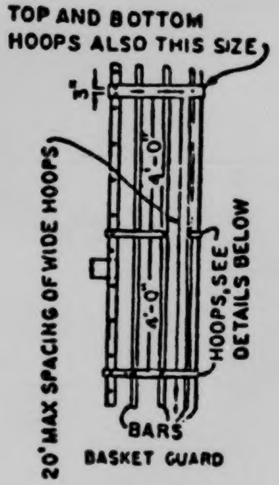
SPECIAL APPLICATIONS

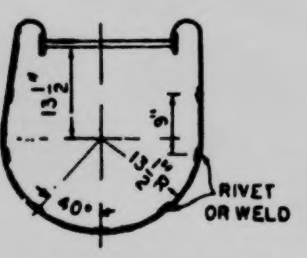

THROUGH LADDER
2'-3"
3'-6" MIN
30' MAX
2'-7"
7' MIN
8' MAX

ACCESS TO LANDING PLATFORM THROUGH LADDER

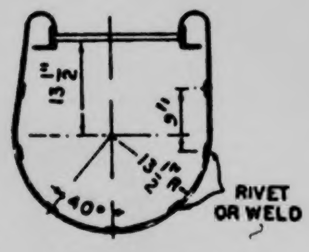

SIDE-STEP LADDER
18"
6" MAX
15" MIN
2'-3"
4'-0"
30' MAX
7' MIN
8' MAX
2'-7"

ACCESS LATERALLY FROM LADDER


TOP AND BOTTOM HOOPS ALSO THIS SIZE
3"
4'-0"
4'-0"
20' MAX SPACING OF WIDE HOOPS
HOOPS, SEE DETAILS BELOW
BARS
BASKET GUARD


13 1/2"
9"
13 1/2" R
40°
RIVET OR WELD

BASKET GUARD HOOP BAR LADDER


13 1/2"
9"
13 1/2" R
40°
RIVET OR WELD

BASKET GUARD HOOP ANGLE IRON LADDER

CAGES FOR LADDERS MORE THAN 20 FEET HIGH

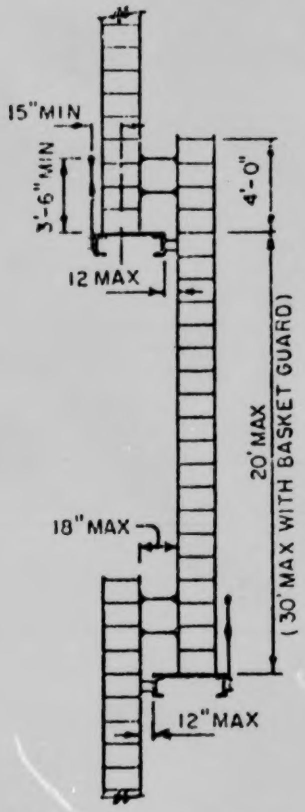
Landing Platforms

1. When ladders are used to ascend to heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof. Where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof. Each ladder section shall be offset from the adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.

2. Where a person has to step a distance greater than 12 inches from the centerline of the rung of a ladder to the nearest edge of the structure or equipment, a landing platform shall be provided. The minimum step-across distance shall be two and one half (2 1/2) inches.

3. All landing platforms shall be equipped with standard railings and toeboards, so arranged as to give safe access to the ladder. Platforms shall be not less than 24 inches in width and 30 inches in length.

4. A one rung ladder shall be located at the level of the landing laterally served by the ladder. Where access to the landing is through the ladder, the same rung spacing as used on the ladder shall be used from the landing platform to the first rung below the landing.



OFFSET FIXED LADDER SECTIONS

47. Is there a first aid kit easily accessible to the work area? S U NA

48. Are emergency phone numbers posted? S U NA

49. Where employees may be exposed to injurious corrosive materials, are they provided with quick-drenching and flushing facilities for immediate emergency use? S U NA

FIRE PROTECTION
(29 CFR 1910.157)

50. Are extinguishers selected for the types of combustibles and flammables in the areas where they are to be used?

Class A Ordinary combustible material fires
Class B Flammable-liquid, or grease fires
Class C Energized electrical equipment fires S U NA

51. Are extinguishers fully charged and in their designated places? S U NA

52. Are extinguishers located along normal paths of travel? S U NA

53. Are extinguisher locations free from obstruction or blockage? S U NA

54. Are extinguishers not mounted too high? If 40 pounds or less, the top must be below 5 feet above floor; greater than 40 pounds, the top must be below 3½ feet above floor. S U NA

55. Have all extinguishers been serviced, maintained, and tagged at intervals not to exceed one year? S U NA

56. Are all extinguishers checked (by management or designated employee) monthly to see if they are in place or if they have been discharged, etc.? S U NA

57. Have all extinguishers been hydrostatically tested according to schedules set for the type of extinguisher? S U NA

OTHER FIRE SUPPRESSION SYSTEMS (if applicable)

SPRINKLER SYSTEMS (29 CFR 1910.159)

58. Is there at least one automatic water supply of adequate pressure, capacity, and reliability? S U NA

59. Are water-flow alarms provided on all sprinklers? S U NA

60. Are the sprinkler systems periodically inspected and continuously maintained? S U NA

61. Are the heads of nozzles pointed in the direction of the potential fire? S U NA

DRY CHEMICAL SYSTEMS (29 CFR 1910.160)

62. Does a competent inspector make annual inspections and perform tests on all dry chemical systems? S U NA

63. Are the inspector's reports kept on file? S U NA

64. Are visual inspections regularly made? S U NA

65. Are all dry chemical systems continuously maintained? S U NA

CARBON DIOXIDE (CO_2) SYSTEMS (29 CFR 1910.161)

66. Are the CO_2 systems inspected and tested yearly? S U NA

67. Are the cylinders weighed or pressure checked twice a year and refilled or replaced if they show a loss of 10% or more? S U NA

MACHINERY AND MACHINE GUARDING (29 CFR 1910.212-.215)

68. Are belts, pulleys, and rotating shafts properly guarded? S U NA

69. Are chains, sprockets, and gears properly guarded? S U NA

70. Are all in-going nip points properly guarded? S U NA

71. Are rotating shafts that are not smooth properly guarded? S U NA

72. Are all rotating parts (lubrication, fittings, etc.) recessed or covered with collars? S U NA

73. Are all pieces of equipment with an electric motor or any electrical connection effectively grounded? S U NA

74. Are sprockets and belt drives within reach of platforms and passageways or less than seven feet from the floor completely enclosed? S U NA

75. Are fans less than seven feet above floor guarded, having openings ½ inch or less? S U NA

76. Are meat saws (band saws) properly guarded? S U NA

77. Are blades on food grinders, choppers, and disposers properly guarded? S U NA

78. Is all fixed machinery securely anchored to prevent movement? S U NA

HAND AND PORTABLE POWER TOOLS
(29 CFR 1910.242-.244)

79. Are tools and equipment in good condition? S U NA

80. Has compressed air used for cleaning been reduced to 30 psi when dead ended? S U NA

81. Have employees been instructed that the use of compressed air to blow debris from clothing or body is prohibited because it can enter the body and cause serious harm? S U NA

82. Have employees been made aware of the hazards caused by faulty or improperly used hand tools? S U NA

BAKERY EQUIPMENT (CFR 1910.263) MIXERS

83. Are horizontal mixers equipped with safety devices which engage both hands of the operator when bowl is more than one-fifth open with agitator in motion under power? S U NA

84. Do vertical mixers have devices available for moving bowls weighing 80 lbs. or more with contents, into and out of the mixing position on the machine? S U NA

MANUALLY FED DOUGH BRAKES

85. Is top roll protection provided? S U NA

86. Is an emergency stop bar provided and located so that the body will press against it if the operator slips and falls toward the rolls, or if the operator gets a hand caught in the rolls? S U NA

87. Is the emergency stop bar checked every 30 days? S U NA

DOUGHNUT MACHINES

88. Are separate flues provided for venting vapors from the frying section and venting products of combustion from the heating chamber used to heat the fat? S U NA

89. Is a type "B" fire extinguisher readily available in the area of the doughnut fryer? S U NA

90. Are goggles or face shields provided to prevent injury from hot fat splashes? S U NA

SLICERS

91. Are all slicers provided with a mechanical device to push the last loaf through the slicer knives? S U NA

NATIONAL ELECTRICAL CODE (1910.308-.309)
ELECTRICAL WIRING

92. Have exposed wires, frayed cords, and deteriorated insulation been repaired or replaced? S U NA

93. Are junction boxes, outlets, switches, and fittings covered? S U NA

NATIONAL ELECTRICAL CODE

94. Have exposed wires, frayed cords, and deteriorated insulation been repaired or replaced? S U NA

95. Are junction boxes, outlets, switches, and fittings covered? S U NA

96. Is all metal fixed electrical equipment grounded? S U NA

97. Does all equipment connected by cord and plug have grounded connections? S U NA

98. Are electrical appliances such as vacuums, blowers, vending machines, etc., grounded? S U NA

99. Are all portable electrical hand tools grounded? (Double-insulated tools are acceptable without grounding.) S U NA

100. Are breaker switches identified as to their use? S U NA

101. Do flexible cords and cables not run through holes in wall or ceiling or through doorways or windows? S U NA

COUNTY	CITY	YEAR	IDENT NO	TYPE	SANIT CODE	MO	DAY	YEAR	TRAVEL TIME	INSP TIME

1974

OWNER'S NAME ______________________

ESTABLISHMENT'S NAME ______________________

STREET ADDRESS ______________________

CITY ______________________

STATE AND ZIP ______________________

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
FOOD SERVICE ESTABLISHMENT
INSPECTION REPORT

Based on an inspection this day, the items circled below identify the violations in operations or facilities which must be corrected by the next routine inspection or such shorter period of time as may be specified in writing by the regulatory authority. Failure to comply with any time limits for corrections specified in this notice may result in cessation of your Food Service operations.

PURPOSE

Regular	29-1
Follow-up	2
Complaint	3
Investigation	4
Other	5

FOOD

ITEM NO.		WT.
*01	Source; sound condition, no spoilage	5
02	Original container; properly labeled	1

FOOD PROTECTION

ITEM NO.		WT.
*03	Potentially hazardous food meets temperature requirements during storage, preparation, display, service transportation	5
*04	Facilities to maintain product temperature	4
05	Thermometers provided and conspicuous	1
06	Potentially hazardous food properly thawed	2
*07	Unwrapped and potentially hazardous food not re-served	4
08	Food protection during storage, preparation, display, service, transportation	2
09	Handling of food (ice) minimized	2
10	In use, food (ice) dispensing utensils properly stored	1

PERSONNEL

ITEM NO.		WT.
*11	Personnel with infections restricted	5
*12	Hands washed and clean, good hygienic practices	5
13	Clean clothes, hair restraints	1

FOOD EQUIPMENT & UTENSILS

ITEM NO.		WT.
14	Food (ice) contact surfaces: designed, constructed, maintained, installed, located	2
15	Non-food contact surfaces: designed, constructed, maintained, installed, located	1
16	Dishwashing facilities: designed, constructed, maintained, installed, located, operated	2
17	Accurate thermometers, chemical test kits provided, gauge cock (¼" IPS valve)	1
18	Pre-flushed, scraped, soaked	1
19	Wash, rinse water: clean, proper temperature	2
*20	Sanitization rinse: clean, temperature, concentration, exposure time; equipment, utensils sanitized	4
21	Wiping cloths: clean, use restricted	1
22	Food-contact surfaces of equipment and utensils clean, free of abrasives, detergents	2
23	Non-food contact surfaces of equipment and utensils clean	1
24	Storage, handling of clean equipment/utensils	1

ITEM NO		WT.
25	Single-service articles, storage, dispensing	1
26	No re-use of single service articles	2

WATER

*27	Water source, safe hot & cold under pressure	5

SEWAGE

*28	Sewage and waste water disposal	4

PLUMBING

29	Installed, maintained	1
*30	Cross-connection, back siphonage, backflow	5

TOILET & HANDWASHING FACILITIES

*31	Number, convenient, accessible, designed, installed	4
32	Toilet rooms enclosed, self-closing doors, fixtures, good repair, clean hand cleanser, sanitary towels/hand-drying devices provided, proper waste receptacles	2

GARBAGE & REFUSE DISPOSAL

33	Containers or receptacles, covered adequate number insect/rodent proof, frequency, clean	2
34	Outside storage area enclosures properly constructed, clean, controlled incineration	1

INSECT, RODENT, ANIMAL CONTROL

35	Presence of insects/rodents – outer openings, protected, no birds, turtles, other animals	4

FLOORS, WALL & CEILINGS

36	Floors, constructed, drained, clean, good repair, covering installation, dustless cleaning methods	1
37	Walls, ceiling, attached equipment constructed, good repair, clean, surfaces, dustless cleaning methods	1

LIGHTING

38	Lighting provided as required, fixtures shielded	1

VENTILATION

39	Rooms and equipment – vented as required	1

DRESSING ROOMS

40	Rooms clean, lockers provided, facilities clean, located	1

OTHER OPERATIONS

*41	Toxic items properly stored, labeled, used	5
42	Premises maintained free of litter, unnecessary articles, cleaning maintenance equipment properly stored. Authorized personnel	1
43	Complete separation from living/sleeping quarters. Laundry	1
44	Clean, soiled linen properly stored	1

RATING SCORE 75-77	
100 less weight of items violated ➔	

*Critical Items Requiring Immediate Attention.

Received by: name____________________

title____________________

Inspected by: name____________________

title____________________

REMARKS ____

DEPARTMENT COPY

COUNTY	CITY	YEAR	IDENT NO	TYPE	SANIT CODE	MO	DAY	YEAR	TRAVEL TIME	INSP TIME

OWNER'S NAME ______________________
ESTABLISHMENT'S NAME ______________________
STREET ADDRESS ______________________
CITY ______________________
STATE AND ZIP ______________________

Wichita-Sedgwick County Department of Community Health

PURPOSE

Regular	1
Follow-up	2
Complaint	3
Investigation	4
Other	5

FOOD SERVICE ESTABLISHMENT INSPECTION REPORT

Based on an inspection this day, the items circled below identify the violations in operations or facilities which must be corrected by the next routine inspection or such shorter period of time as may be specified in writing by the regulatory authority. Failure to comply with any time limits for corrections specified in this notice may result in cessation of your Food Service operations.

ITEM NO		WT
FOOD		
*01	Source: sound condition, no spoilage	5
02	Original container, properly labeled	1
FOOD PROTECTION		
*03	Potentially hazardous food meets temperature requirements during storage, preparation, display, service transportation	5
*04	Facilities to maintain product temperature	4
05	Thermometers provided and conspicuous	1
06	Potentially hazardous food properly thawed	2
*07	Unwrapped and potentially hazardous food not re-served	4
08	Food protection during storage, preparation, display, service, transportation	2
09	Handling of food (ice) minimized	2
10	In use, food (ice) dispensing utensils properly stored	1
PERSONNEL		
*11	Personnel with infections restricted	5
*12	Hands washed and clean, good hygienic practices	5
13	Clean clothes, hair restraints	1
FOOD EQUIPMENT & UTENSILS		
14	Food (ice) contact surfaces: designed, constructed, maintained, installed, located	2
15	Non-food contact surfaces: designed, constructed, maintained, installed, located	1
16	Dishwashing facilities: designed, constructed, maintained, installed, located, operated	2
17	Accurate thermometers, chemical test kits provided, gauge cock (¼" IPS valve)	1
18	Pre-flushed, scraped, soaked	1
19	Wash, rinse water: clean, proper temperature	2
*20	Sanitization rinse: clean, temperature, concentration, exposure time; equipment, utensils sanitized	4

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ITEM NO		WT.
21	Wiping cloths: clean, use restricted	1
22	Food-contact surfaces of equipment and utensils clean, free of abrasives, detergents	2
23	Non-food contact surfaces of equipment and utensils clean	1
24	Storage, handling of clean equipment/utensils	1
25	Single-service articles, storage, dispensing	1
26	No re-use of single service articles	2

WATER

*27	Water source, safe: hot & cold under pressure	5

SEWAGE

*28	Sewage and waste water disposal	[illegible]

PLUMBING

29	Installed, maintained	[illegible]
*30	Cross-connection, back siphonage, backflow	[illegible]

TOILET & HANDWASHING FACILITIES

*31	Number, convenient, accessible, designed, installed	[illegible]
32	Toilet rooms enclosed, self-closing doors, fixtures, good repair, clean: hand cleanser, sanitary towels/hand-drying devices provided, proper waste receptacles	2

GARBAGE & REFUSE DISPOSAL

33	Containers or receptacles, covered: adequate number insect/rodent proof, frequency, clean	2
34	Outside storage area enclosures properly constructed, clean: controlled incineration	[illegible]

INSECT, RODENT, ANIMAL CONTROL

*35	Presence of insects/rodents – outer openings, protected, no birds, turtles, other animals	[illegible]

FLOORS, WALL & CEILINGS

36	Floors, constructed, drained, clean, good repair, covering installation, dustless cleaning methods	1
37	Walls, ceiling, attached equipment: constructed, good repair, clean, surfaces, dustless cleaning methods	1

LIGHTING

38	Lighting provided as required, fixtures shielded	1

VENTILATION

39	Rooms and equipment – vented as required	1

DRESSING ROOMS

40	Rooms clean, lockers provided, facilities clean, located	1

OTHER OPERATIONS

*41	Toxic items properly stored, labeled, used	5
42	Premises maintained free of litter, unnecessary articles, cleaning maintenance equipment properly stored. Authorized personnel	1
43	Complete separation from living/sleeping quarters. Laundry	1
44	Clean, soiled linen properly stored	1

RATING SCORE	
100 less weight of items violated ➔	☐☐☐

*Critical Items Requiring Immediate Attention

Received by: name____________________

title____________________

Inspected by: name____________________

title____________________

Agent of the Secretary
Kansas Department of Health & Environment

REMARKS ____________________

T103-165
Rev. 10-78

WICHITA AREA VOCATIONAL-TECHNICAL SCHOOL
FOOD SERVICE SUPERVISION PROGRAM

SANITATION CHECKLIST

WORK AREA

	YES	NO
1. Does general appearance of the department indicate frequent cleaning of rooms and equipment?		
2. Are floors constructed so they can be cleaned easily?		
3. Are floors in good repair?		
4. Do floors have anticlog traps?		
5. Are walls and ceilings clean?		
6. Are walls and ceilings in good repair?		
7. Are walls and ceilings smooth and easy to wash?		
8. Are there any overhead pipes that might leak into food or equipment?		
9. Are doors and windows effectively screened?		
10. Are outside doors self-closing?		
11. Are mats and duckboards clean?		
12. Are food preparation areas well lighted?		
13. Are all rooms adequately ventilated so as to be reasonably free of disagreeable odors and condensation?		
14. Are storage areas and containers cleaned frequently?		
15. Are hand-washing facilities convenient?		
16. Is pest control effective (ratproofing, insect spray?)		

WATER AND ICE SUPPLY

	YES	NO
1. Is the water supply safe?		
2. Is the supply of hot and cold water adequate?		
3. Is water accessible to all rooms in which food is prepared or utensils washed?		
4. Is ice received from an approved source?		
5. Are ice and ice-handling utensils properly stored?		
6. Are ice machines properly cleaned?		

EQUIPMENT AND KITCHENWARE

	YES	NO
1. Are all equipment and utensils smooth-surfaced and not readily corrodible?		
2. Are all utensils and equipment in good repair — that is, free of breaks, open seams, cracks, and chips?		
3. Are kitchenware and food-contact surfaces of equipment clean to sight and touch?		
4. Are surfaces of all equipment accessible for cleaning?		
5. Are utensils, kitchenware, and equipment stored in clean, dry places at sufficient height from the floor, and protected from flies, dust, and other contamination?		
6. Are proper utensils used to minimize handling of foods?		
7. Are there adequate facilities for maintaining food at hot and cold temperatures?		
8. Are the refrigerators equipped with thermometers?		
9. Are wiping cloths clean?		
10. Is their use properly restricted?		

GARBAGE DISPOSAL

	YES	NO
1. Is garbage removed frequently?		
2. Are receptacles and liners nonabsorbent?		
3. Are receptacles covered by close-fitting lids?		
4. Are receptacles washed when emptied?		
5. Are receptacles disinfected frequently?		
6. Is the storage area kept clean?		
7. Is the storage area refrigerated?		

WICHITA PUBLIC SCHOOLS SAFETY INSPECTION CHECKLIST

SCHOOL____________________ AREA________________ DATE________

TEACHER____________ ROOM____________ INSPECTED BY____________

PURPOSE

A safe environment is an essential part of the safety education program and will exist only if hazards are discovered and corrected through regular and frequent inspections by school personnel. A safety inspection checklist in an objective tool for maintaining safe working conditions and will help accomplish the following:

1. Inform and educate personnel to recognize safety factors and hazards in their environment and enable them to evaluate their safety program;
2. Provide the principal with documentation to plan the next year's building improvement budget; and
3. Maintain a cumulative record of safety inspections.

INSTRUCTIONS FOR USE

The instructions listed below shall be followed in order to assure maximum value from the safety inspection checklist.

1. Safety inspections shall be planned in advance, made annually, and conducted in accordance with Board Policy 1300.00.
2. Designated personnel shall complete the checklist for each area and recommend corrective action.
3. If unsatisfactory responses are recorded on the checklist, the building principal shall initiate and monitor further corrective action.
4. A written request form for **each item** that requires assistance from School ServiceCenter personnel to correct an unsafe condition listed on the checklist recommendation sheet shall be submitted to the Special Services Coordinator.

   Extremely hazardous and unhealthful conditions requiring ***immediate attention*** shall be reported by calling the Special Services Coordinator; also, a written request form shall be submitted as outlined above.
5. The individuals making the inspection shall compare the current findings with previous reports to determine progress. Conditions and locations wherein accidents are most probable shall be given special attention.
6. The Kansas State Department of Human Resources will monitor compliance with local, state, and national safety codes and regulations.

CHECKING PROCEDURE

Draw a circle around the appropriate letters, using the following code: S — Satisfactory (needs no attention); U — Unsatisfactory (needs immediate attention); NA — Not Applicable. Respond to all items.

WHITE COPY Principal GOLDENROD - Special Services Coordinator. GREEN - Teacher.
BLUE - Subject Director/Coordinator. CANARY - Division Director

*Information listed on this page is used as a cover sheet of each curriculum area following.

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ELEMENTARY AND SECONDARY SCHOOLS

A. FIRE PREVENTION AND CODES

1. Fire alarms are checked daily to assure they are working properly and logged in the fire book .... S U NA
2. Fire drill is conducted monthly and logged in fire book .... S U NA
3. Fire extinguishers fully charged and safety seal intact .... S U NA
4. Fire extinguisher's inspection tag shows record of inspection in last 30 days .... S U NA
5. Fire extinguisher's access is unobstructed .... S U NA
6. Fire alarm access is unobstructed .... S U NA
7. Fire escapes in good condition and access to them is clear .... S U NA
8. Fire doors not blocked open .... S U NA
9. Fusible fire links in rolling fire doors intact and not painted .... S U NA
10. Smoke-operated door closures operating satisfactorily .... S U NA
11. Exit lights working .... S U NA
12. Flammables (duplicating fluid, thinners, oil base paints), stored in O.S.H.A. approved metal cabinets .... S U NA
13. "No Smoking" signs installed near duplicating machines .... S U NA
14. Excess trash, paper, debris removed from and around building and site .... S U NA
15. Kiln area (within 3 ft.) is free from combustibles, wood, paper, etc .... S U NA
16. Oil mop heads being stored in metal containers with lids .... S U NA
17. Storage areas are neat and orderly .... S U NA
18. Annex heating systems must have 3 ft. clearance around heater .... S U NA
19. Lounges — ventilated for smoking — ash trays available and fire extinguishers .... S U NA
20. All fabric wall hangings fire-proofed (murals, curtains, drapes, macrame, etc.) .... S U NA
21. Kitchen stove in good operating condition .... S U NA

Comments and locations of items marked "U": ____________________

____

____

____

B. ELECTRICAL HAZARDS

1. Floor machines and equipment properly grounded (third prong) .... S U NA
2. Metal portable hand tools properly grounded (third prong) (not applicable to double insulated, plastic case tools) .... S U NA
3. Extension cords (approved type by Electrical Department, Plant Facilities only) .... S U NA
4. No extension cords being used as permanent wiring (such use is illegal) .... S U NA
5. Condition of extension cords .... S U NA
6. Condition of electrical plugs, wall outlets and switches .... S U NA
7. Electrical switch panels clear from storage so access is available at all times .... S U NA
8. No use of multiple plug ins .... S U NA
9. Circuits not overloaded causing breakers to trip out .... S U NA
10. All electrical breakers identified in electrical panel .... S U NA
11. Portable fans less than 7 ft. from floor with larger than ½" openings must have guards .... S U NA
12. Electrical hand tools and similar equipment unplugged when not in use .... S U NA

Comments and locations of items marked "U": ____________________

____

____

C. EXITS — AISLES — FLOORS

1. Aisles established and clear .... S U NA
2. Floors free of holes, cracks, and broken and/or missing tiles causing tripping hazard .... S U NA
3. Entrance mats installed and in good repair .... S U NA
4. Floors free from slippery areas (custodian should use non-slip wax) .... S U NA
5. Carpets secure; seams in good repair; carpets fireproofed .... S U NA
6. Panic bars in good operating condition .... S U NA
7. Center posts (mullions) in double doors secure .... S U NA
8. No deadbolts in classroom doors .... S U NA
9. Proper signs on all doors used for exits .... S U NA

Comments and locations of items marked "U": ____________________

____

____

D. STAIRWAYS — HALLS — RAMPS — BALCONIES

1. Handrails available and in good condition .... S U NA
2. Stair treads in good condition .... S U NA
3. Toe boards on balcony railings .... S U NA
4. Non-slip surfaces on ramps and stairs .... S U NA
5. Stairways and landings completely clear of storage .... S U NA
6. Hallways completely clear of storage and furniture .... S U NA
7. Annex entrance steps, landing and railings in good repair .... S U NA
8. Stairways, halls, and balconies lighted .... S U NA

Comments and locations of itemsmarked "U": ____________________

____

____

E. BOILER ROOM — MECHANICAL ROOM

1. Boiler rooms not being used as teachers' lounges .... S U NA
2. Boiler rooms not being used for storage for other than approved custodial items .... S U NA
3. Tunnel areas not being used for storage .... S U NA
4. "No Storage" yellow caution lines painted on floor in front of electrical panels and in front of broilers .... S U NA
5. General housekeeping .... S U NA
6. No storage of combustibles .... S U NA
7. Emergency generator working properly — no storage near engine or exhaust .... S U NA
8. All ladders in good repair and with rubber shoes to prevent slipping .... S U NA
9. Open pulleys and rotating shafts properly guarded (air compressors and return pumps) .... S U NA
10. Monthly custodian test of safety release valve on steam boilers only .... S U NA

Comments and locations of items marked "U": ____________________

____

____

ELEMENTARY AND SECONDARY SCHOOLS

F. GROUNDS

1 Sidewalks in good repair .... S U NA
2 Play equipment in good repair .... S U NA
3 Play equipment free of safety hazards .... S U NA
4 Play equipment appropriately located .... S U NA
5 Pot holes on playgrounds filled .... S U NA
6 Play areas under playground equipment sanded .... S U NA
7 Manhole/meter box covers in place .... S U NA
8 Foot scrapers in good repair .... S U NA
9 Entrance steps in good repair .... S U NA
10 Driveways in good repair .... S U NA
11 Parking lots in good repair .... S U NA
12 Trees free from dead branches .... S U NA
13 Fencing around playgrounds near streets .... S U NA

Comments and locations of items marked "U": ______________________

____

____

G. INSTRUCTION

1 Safety is taught as a part of each teaching unit as appropriate .... S U NA
2 Safety rules are posted in areas where needed .... S U NA
3 Protective devices are provided where hazards exist .... S U NA
4 Equipment and tools used for instruction are in good repair .... S U NA
5 Safety practices are observed when using kilns, home living equipment and hand power tools used in classrooms .... S U NA
6 Toxic, flammable chemicals or liquids used under strict, adult supervision, including proper ventilation and protective apparel .... S U NA

Comments and locations of items marked "U" ______________________

____

____

H. GENERAL

1 Chairs -- mechanical condition, springs and castors .... S U NA
2. Safe step stools in use .... S U NA
3. Ventilation where required .... S U NA
4. Safe stacking of supplies .... S U NA
5. Heavy storage files secured from tipping .... S U NA
6. Storage shelving secured to wall to prevent tipping .... S U NA
7. Hot pipes insulated .... S U NA
8. Paper cutter blades in down position and locked when not in use .... S U NA
9. Cleaning chemicals and poisons stored in safe places and used under controlled conditions with strict, adult supervision .... S U NA
10 First aid kit available and properly stocked .... S U NA
11 Reading lofts and similar structures constructed properly .... S U NA

Comments and locations of items marked "U" ______________________

____

ELEMENTARY AND SECONDARY SCHOOLS
RECOMMENDATIONS

School______________________ Room______________ Date______________

Inspected By ______________________

Code No.	

FOOD SERVICE CAFETERIA INSPECTION REPORT

FOOD

Approved Source; sound condition, no spoilage specify products: Eggs, Meat, Fish, Frozen desserts, ... S U NA
Milk and Milk products .... S U NA
Original container; properly labeled .... S U NA

FOOD PROTECTION

Potentially hazardous food meets temperature requirements during storage, preparation, display, service transportation .... S U NA
Facilities to maintain product temperature, potentially hazardous food at 45° F. or below or 140° F. or above as required .... S U NA
Thermometers provided and conspicuous .... S U NA
Potentially hazardous food properly thawed .... S U NA
Unwrapped and potentially hazardous food not re-served .... S U NA
Handling of food minimized by use of suitable utensils and plastic gloves .... S U NA
Foods: cooked and held at proper temperature .... S U NA
Fruits and vegetables washed thoroughly .... S U NA
containers of food stored 6" off the floor and on clean surfaces .... S U NA
No wet storage of packaged food .... S U NA
Display cases, counter protector devices or cabinets of approved type S U NA
Frozen dessert and ice dippers or scoops properly stored .... S U NA
Condiments in closed dispensers or individual package .... S U NA

FOOD EQUIPMENT AND UTENSILS

Poisonous and toxic materials properly identified, colored, stored and used; poisonous polishes not present .... S U NA
Bactericides, cleaning and other compounds properly stored and non-toxic in use dilutions .... S U NA
Food contract surfaces; designed (open seams, cleanable surface, construction, maintained) free from pits, cracks, chips, no corrosion, properly installed, located .... S U NA
Non-food contact surfaces, designed, constructed, maintained, installed, located .... S U NA
Dishwashing facilities; designed, constructed, maintained, installed, located .... S U NA
Accurate thermometers, chemical test kits provided, gauge cock (¼" IPS value) .... S U NA
Utensils and equipment pre-flushed, scraped and soaked .... S U NA
Food contact surfaces of equipment and utensils, clean, free of abrasives, detergents .... S U NA
Non-food contact surfaces of equipment and utensils clean .... S U NA
Tableware clean to sight and touch .... S U NA
Grills and similar cooking devices cleaned daily .... S U NA
Clean wiping cloths used (in sanitizing solution; properly restricted) .. S U NA
Tableware sanitized .... S U NA
Kitchenware and food contact surfaces of equipment used for potentially hazardous food sanitized .... S U NA
Facilities for washing and sanitizing equipment and utensils approved, properly constructed, maintained and operated .... S U NA
Wash, rinse water; clean, proper temperature .... S U NA
Dish tables and drain boards provided, properly located and constructed .... S U NA
Adequate and suitable detergents used .... S U NA
Approved thermometers provided and used 0° F-220° F .... S U NA
Suitable dish baskets provided .... S U NA
Cleaned and sanitized utensils, and equipment properly stored and handled; utensils air-dried .... S U NA
Single-service articles properly stored, dispensed (straw, napkins, paper cups, etc.) .... S U NA

PERSONNEL: HEALTH AND DISEASE CONTROL

Persons with boils, infected wounds, respiratory infections or other communicable disease properly restricted .... S U NA
Known or suspected communicable disease cases report to health authority .... S U NA
Hands washed and cleaned .... S U NA
Clean outer garments; proper hair restraints used .... S U NA
Good hygiene practices .... S U NA

WATER

Water, approved source, safe; hot and cold running water provided ... S U NA
Ice from approved source .... S U NA
Ice machine and facilities properly located, installed and maintained .. S U NA
Ice and ice handling utensils properly handled and stored S U NA

SEWAGE

Approved sewage and waste water disposal .... S U NA

PLUMBING

Properly installed, sized and maintained .... S U NA
No cross-connections, back siphonage, backflow .... S U NA

TOILET AND HAND WASHING FACILITIES

Adequate, conveniently located, and accessible; properly designed and installed .... S U NA
Toilet rooms completely enclosed, and equipped with self-closing tight-fitting doors; doors kept closed .... S U NA

TOILET AND HAND WASHING FACILITIES

Toilet rooms, fixtures and vestibules kept clean, in good repair, and free from odors .... S U NA
Toilet tissue and covered waste receptacles provided; waste receptacles emptied as necessary .... S U NA
Lavatories provided, adequate properly located and installed, clean and in good repair .... S U NA
Suitable hand cleaners and sanitary towels or approved hand-drying devices provided .... S U NA

GARBAGE AND REFUSE DISPOSAL

Containers or receptacles, covered; adequate number, insect/rodent proof, frequency, clean .... S U NA
Outside storage area enclosures properly constructed, clean, controlled incineration .... S U NA

INSECT, RODENT, ANIMAL CONTROL

Presence of insects/rodents — outer openings protected against flying insects as requires; rodent proof .... S U NA
Harborage and feeding of vermin prevented .... S U NA

FLOORS, WALLS AND CEILINGS

Floors constructed, drained, clean, good repair, coverings installed (carpet), dustless cleaning method .... S U NA
Walls, ceilings attached equipment; constructed, good repair (no cracks, holes, etc), clean, surfaces, dustless cleaning method .... S U NA
Mats and duct boards cleanable, removable clean .... S U NA

ART DEPARTMENT

A. GENERAL PHYSICAL CONDITION/HOUSEKEEPING

1. Machines, benches and other equipment are arranged so as to conform to good safety practices .... S U NA
2. Storage in storerooms is neat and orderly .... S U NA
3. General appearance as to orderliness .... S U NA
4. Ventilation is adequate and proper for conditions .... S U NA
5. Illumination is safe, sufficient, and well placed .... S U NA
6. Lockers and drawers are inspected regularly for cleanliness and fire hazards .... S U NA
7. Air in the room is free from excessive dust, smoke, etc. .... S U NA
8. Fire approved storage cabinets are provided for all flammable and combustible materials .... S U NA
9. Chemicals are properly stored and labeled .... S U NA
10. A sufficient number of properly charged fire extinguishers (periodically inspected, dated and recharged) are readily accessible in all areas .... S U NA
11. Area behind fire extinguisher is color coded .... S U NA

B. EQUIPMENT

1. All gears, moving belts, etc. are protected by permanent enclosure guards .... S U NA
2. Machines are in safe working condition .... S U NA
3. Machines are fastened securely in place .... S U NA
4. Instructions and approved warning signs for safe use of machines are posted near the machines .... S U NA
5. Kiln operations must comply with Uniform Fire Code .... S U NA
6. Gas kiln room must be free of combustibles .... S U NA
7. Automatic temperature and safety controls are installed .... S U NA
8. Properly designed and constructed equipment is used for handling molten metal when casting .... S U NA

C. WELDING — SOLDERING

1. Cylinders are secured upright with secuirty chains, clear of passageways, stored in ventilated areas, and full containers are not stored in sunlight .... S U NA
2. Hoses are maintained in good condition .... S U NA
3. Only spark lighters are used to light torches .... S U NA
4. Anti (fire) flashbacks are installed where required in all hoses and lines .... S U NA

D. ELECTRICAL

1. All electrical extension cords are in safe condition and are not carrying excessive loads or used as permanent circuits .... S U NA
2. No temporary wiring is in evidence .... S U NA
3. All outlets and machines are grounded electrically .... S U NA

E. NATURAL GAS

1. Gas appliances have been adjusted so that they may be lighted without undue hazard .... S U NA
2. There are no gas leaks, nor any gas odor detectable in the room .... S U NA
3. Gas-operated equipment is ignited from an automatic ignition system (excluding small gas operated soldering furnaces) .... S U NA

F. PERSONAL PROTECTION

1. Goggles glasses, or protective shields, meeting USA standards Z87 1.1968, are provided and required for all work where eye hazards exist .... S U NA
2. First aid cabinets are available and completely stocked .... S U NA
3. Pupil's hair is short or fastened back of head when using machines ... S U NA
4. Safety is taught as an integral part of each teaching unit .... S U NA

RECOMMENDATIONS

School ______________________ Room ____________ Date ______________

Teacher ______________________ Inspected by ______________________

Code No.	

Safety Inspection Checklist
for Drama, Stagecraft, Music, & Auditorium Areas

A. GENERAL PHYSICAL CONDITION/HOUSEKEEPING

1. Stairwells cleared and illuminated .... S U NA
2. Stage floor well maintained .... S U NA
3. Storage of props neat and orderly .... S U NA
4. Storage of costumes is inspected for fire hazards .... S U NA
5. Number and location of exits adequately identified, unblocked and unchained .... S U NA
6. Electrical panels marked and identified .... S U NA
7. Safety areas in front of electrical panels are clear .... S U NA
8. Safety areas in front of fire extinguishers are clear .... S U NA
9. Quantity of storage for stage equipment is adequate .... S U NA
10. Adequate number of properly charged fire extinguishers both electric and wood (periodically inspected, dated and recharged) is readily accessible in all areas) .... S U NA
11. Area behind fire extinguishers is color coded .... S U NA
12. A toe-board and railing around mezzanine used for storage .... S U NA
13. Tool, supply or material room is orderly .... S U NA
14. Illumination is safe, sufficient, and well placed .... S U NA
15. Power tools, work benches and other equipment are arranged so as to conform to good safety practices .... S U NA
16. No smoking signs are placed in all backstage areas .... S U NA
17. No temporary wiring is in evidence .... S U NA
18. Protective enclosure around light dimmer board can be locked .... S U NA
19. Lock railings, pin railings, or counterweights are clearly marked for safe operations .... S U NA
20. Catwalks are sufficiently lighted and unblocked .... S U NA
21. Orchestra pit can be enclosed by a safety rope .... S U NA
22. All curtains and draperies have been flame proofed according to fire code .... S U NA
23. Sufficient scrap boxes and trash containers are used .... S U NA
24. Lockers and drawers are inspected regularly for cleanliness and fire hazards .... S U NA
25. Ventilation is adequate and proper for conditions .... S U NA
26. No combustible products or enamel paints are in evidence .... S U NA
27. Storage for stage scenery is adequate and meets codes .... S U NA
28. Enclosure is provided when trap door is used .... S U NA
29. Storage shelving secured to wall to prevent tipping .... S U NA
30. Ropes on pin rails and counterweights are inspected for wear every year .... S U NA
31. Dressing rooms are adequate and kept clean .... S U NA
32. Music practice rooms are kept neat, clean, and free of storage .... S U NA
33. Storage for musical instruments is adequately arranged .... S U NA
34. ____________________ S U NA
35. ____________________ S U NA

B. EQUIPMENT, TOOLS AND PROPS

1. Power tools and machines are arranged so workers are protected from hazards of other workers or passing students .... S U NA
2. Machines are guarded to comply with OSHA Standards .... S U NA
3. All gears, moving belts, etc., are protected by permanent enclosure guards .... S U NA
4. All power tools and machines are in safe working condition .... S U NA
5. All equipment is properly grounded electrically .... S U NA
6. Nonskid areas are provided around machines .... S U NA
7. Instructions and approved warning signs for safe use of equipment and machines are posted near the machines .... S U NA
8. Illumination is safe, sufficient and well placed .... S U NA
9. All sound shells are in safe, operable mechanical condition .... S U NA
10. Tools are stored orderly in well marked storage facilities .... S U NA
11. Stage props can be locked for safe-keeping .... S U NA
12. Extension cords, three-wire construction, are used .... S U NA
13. All outlets and tools are grounded electrically .... S U NA
14. Only OSHA approved stools and ladders are used .... S U NA
15. All materials (lumber, nails, glue, paint, hardware, casters) are safely stacked or stored .... S U NA
16. Cables and electrical cords of all kinds which rest on the floor are taped down or covered during performance to prevent tripping .... S U NA
17. Scaffolding used for staging or work is safely anchored .... S U NA
18. Flash pots and other dangerous props are strictly supervised by faculty .... S U NA
19. Construction of stage sets or scenery is supervised by a qualified adult .... S U NA
20. Inflammable materials are used with adequate ventilation and stored in an approved storage locker .... S U NA
21. Stage lighting is set and adjusted under close supervision of a qualified instructor .... S U NA
22. Stage area is not used for general school storage .... S U NA
23. ____________________ S U NA
24. ____________________ S U NA

C. PERSONAL PROTECTION

1. Appropriate kind of wearing apparel is worn properly for backstage activities .... S U NA
2. Clothing of students is free from loose sleeves, flopping ties or scarves .... S U NA
3. Pupils' hair is short or fastened back when using power equipment .... S U NA
4. Rings and other jewelry are removed by pupils when working with machine tools .... S U NA
5. Rubber gloves are used when working with substances hazardous to the skin .... S U NA
6. Safety person is required to wear a hard hat while standing at foot of A-frame ladders when used for high work .... S U NA
7. Pupils have had a recent Tetanus shot .... S U NA
8. Safety belts are worn and lanyards are used while working in lofts or catwalks .... S U NA
9. Eye protectors meeting USA Standards Z 87 1 1975 are worn when operations present the hazard of flying objects, glass, liquids, or other dangers .... S U NA
10. Hard hats are worn when hazards of impact and penetration are present from falling flying objects .... S U NA
11. Goggles or safety glasses are provided and required for work where eye hazards exist .... S U NA
12. Obligatory back guardrails have been installed on platforms above ten feet in height .... S U NA
13. ____________________ S U NA
14. ____________________ S U NA

D. INSTRUCTION

1. Safety is taught as an integral part of each teaching unit .... S U NA
2. A general stagecraft safety test is issued to each pupil enrolled in drama, stagecraft, or drama clubs. The completed copy is kept on file and is signed by the pupil .... S U NA
3. Printed safety rules are given to students after careful discussion .... S U NA
4. Special effort is made to discourage horseplay or tomfoolery backstage .... S U NA
5. Procedure to be followed in case of fire backstage during performance is clearly defined for every student .... S U NA
6. Specific units of safety are taught in stage construction and stage lighting .... S U NA
7. Emergency procedures in case of an accident backstage are explained and listed near first aid area .... S U NA
8. ____________________ S U NA
9. ____________________ S U NA

E. FIRST AID

1. An adequately stocked first aid cabinet is provided .... S U NA
2. The school has individuals qualified to administer first aid .... S U NA
3. First aid cabinet supplies are checked and restocked periodically .... S U NA
4. ____________________ S U NA
5. ____________________ S U NA

HOME ECONOMICS EDUCATION

School____________________________Curriculum Area________________________Date________________

Teacher____________________________________Room______________Inspected by________________________

1. Safety is taught within the classroom .... S U NA
2. All major electrical equipment is properly grounded (3-prong plug) .. S U NA
3. All electrical cords are safe .... S U NA
4. A sufficient number of safe outlets are available .... S U NA
5. Classroom furniture, equipment, and appliances arranged as to protect students from hazards of other equipment, passing students, and to allow freedom of movement .... S U NA
6. Floors and hallways are clean, dry, free of materials, and in good repair .... S U NA
7. Ventilation is adequate and proper for existing conditions .... S U NA
8. All storage areas are clean and orderly .... S U NA
9. Adequate and proper storage space is available .... S U NA
10. All materials, linens, toys, equipment, tools, and appliances are maintained in a clean and safe manner according to their specified use ... S U NA
11. All materials, toys, equipment, tools, and appliances are used according to manufacturers directions and/or intended use .... S U NA
12. Safety hazards are properly marked and/or guarded .... S U NA
13. All equipment switches are within easy reach of the operator and easy to operate .... S U NA
14. Illumination is safe, sufficient and well placed .... S U NA
15. Machines and equipment remain securely in place when in use ...... S U NA
16. Insecticides, household cleaners, paints, solvents, etc., are stored separately, out of reach, and in appropriately labeled containers ..... S U NA
17. Electrical appliances and equipment are UL approved .... S U NA
18. Safe stepladders or stands for reaching high places are being used .. S U NA
19. If small children are present, electrical outlets are covered .... S U NA
20. Windows and doors are closed or screened .... S U NA
21. Waste containers are clean and plastic liners are used .... S U NA
22. Food items are stored properly to control air, moisture, temperature (45 ° F and below for cold foods), infestation, and are permanently labeled .... S U NA
23. There are no gas leaks, nor the presence of the odor of gas .... S U NA
24. Adequate classroom supervision is maintained; tasks are appropriate to the abilities and development of the student .... S U NA
25. Fingers are kept away from moving parts such as belts and blades (Guards are installed on industrial equipment) .... S U NA
26. Cleaning or adjusting is done before the machine is plugged into the source of power .... S U NA
27. Personal cleanliness and habits are demonstrated .... S U NA
28. All waste materials are properly disposed of quickly .... S U NA
29. Clean aprons are properly worn and are in good condition .... S U NA
30. Clothing is free of loose sleeves, and flopping ties .... S U NA
31. Coats are not worn in the foods laboratory .... S U NA
32. Long hair is restrained .... S U NA
33. No combs, brushes, and other grooming aids are used in the foods laboratory .... S U NA
34. Pot holders are used to handle hot items .... S U NA
35. Electrical items are handled with dry hands .... S U NA
36. Hot grease and oil is handled carefully; the amount of heat is carefully regulated .... S U NA
37. Pot handles are turned away from stove front, but not over another burner .... S U NA
38. Food is handled and prepared in a safe, sanitary manner .... S U NA
39. Electrical cords are pulled from the wall outlet before the opposite end of the cord is pulled from the appliance .... S U NA
40. Household products are never mixed .... S U NA
41. Directions and warnings are read on all labels of potentially hazardous or poisonous substances .... S U NA
42. Flammable materials are not stored on or near ranges or other sources of heat .... S U NA
43. Broken, chipped or cracked utensils and dishes have been discarded .... S U NA
44. Ovens, ranges, broilers, and drip pans are free from grease .... S U NA
45. Rinse water is hot enough to sterilize dishes or a sanitizing agent is used in the water .... S U NA

RECOMMENDATIONS

School ________________________________ Room ___________________ Date ________________

Teacher _________________________________ Inspected by ______________________________

Code No.	

INDUSTRIAL EDUCATION

A. GENERAL PHYSICAL CONDITION/HOUSEKEEPING

1. Machines, benches, and other equipment are arranged to conform to good safety practices ....S U NA
2. Condition of stairways ....S U NA
3. Storage under stairways ....S U NA
4. Storage in storerooms is neat and orderly ....S U NA
5. Condition of aisles ....S U NA
6. Condition of floors ....S U NA
7. General appearance as to orderliness ....S U NA
8. Ventilation is adequate and proper for conditions ....S U NA
9. Illumination is safe, sufficient, and well placed ....S U NA
10. Number and location of exits are adequate, properly identified, unblocked, and unchained ....S U NA
11. Lockers and drawers are inspected regularly for cleanliness and fire hazards ....S U NA
12. Utility tunnels are not blocked ....S U NA
13. Air in the room is free from excessive dust, smoke, etc. ....S U NA
14. Adequate and proper storage space for tools and materials ....S U NA
15. Tool, supply, and/or material room is orderly ....S U NA
16. Sufficient scrap material boxes or barrels are provided and used ....S U NA
17. Materials are stored in an orderly and safe condition ....S U NA
18. A spring-lid metal container is provided for waste and oily rags ....S U NA
19. All waste materials and oily rags are promptly placed in approved containers that are emptied regularly ....S U NA
20. Fireproof storage cabinets are provided for all flammable and combustible materials ....S U NA
21. Quantity of stored flammables and combustibles meets code ....S U NA
22. Approved safety cans are provided for flammable and combustible liquids ....S U NA
23. Bulk storage of dangerous materials is provided outside of the main building ....S U NA
24. Mezzanine level has toe-board and railing ....S U NA
25. Chemicals are labeled and stored properly ....S U NA
26. A sufficient number of charged fire extinguishers (periodically inspected, dated, and recharged) is readily accessible in all areas ....S U NA
27. Area behind fire extinguisher is color coded ....S U NA
28. Dust collection systems are clean ....S U NA
29. Spray room or booth meets Uniform Fire Code ....S U NA
30. Air filters are properly cleaned and maintained ....S U NA
31. Approved warning and caution signs are posted in the laboratory ....S U NA
32. Safety color codes are used for marking physical hazards ....S U NA
33. ______________________________ S U NA
34. ______________________________ S U NA

B. EQUIPMENT

1. Machines are arranged so that workers are protected from hazards of other machines, passing pupils, etc. ....S U NA
2. Danger zones on machines are properly indicated ....S U NA
3. All gears, moving belts, etc., are protected by permanent enclosure guards ....S U NA
4. All equipment control switches are easily accessible to operate ....S U NA
5. Nonskid areas are provided around machines ....S U NA
6. Machines are in safe working condition ....S U NA
7. Machines are guarded to comply with OSHA Standards and local policy ....S U NA
8. Machines are fastened securely in place ....S U NA
9. Engine stands are of approved construction ....S U NA
10. All hoists and A-frames are properly constructed, designed for the job undertaken, labeled as to capacity, and fitted with safety locks ....S U NA
11. All air hoses with nozzles have air reducers that are limited to 30 psi or less ....S U NA
12. ______________________________ S U NA
13. ______________________________ S U NA

C. WELDING

1. Welding area is free of combustible and flammable materials ....S U NA
2. Cylinders are secured upright with security chains, clear of passageways, stored in ventilated areas, and full containers are not stored in sunlight ....S U NA
3. Storage of extra cylinders meets Kansas State Department of Human Resources and National Fire Prevention regulations ....S U NA
4. Gas pipelines (manifolds) have been installed and are maintained according to code ....S U NA
5. Piped welding systems have back pressure valves in both lines and conveniently located shutoff valves which are not quick opening ....S U NA
6. Torches and regulators are clean, well maintained, and in good operating condition ....S U NA
7. Hoses are maintained in good condition ....S U NA
8. Only spark igniters are used to light torches ....S U NA
9. Flashback arrestors are installed in all hoses and lines where required ....S U NA
10. The fixed welding stations are located so that an arc cannot be struck on gas cylinders, gas lines, or water lines ....S U NA
11. Reflective screens are provided and used to shield others from arc flashes and burns ....S U NA
12. When items to be welded will not fit into screened area, all persons near area will be provided protective equipment ....S U NA
13. Arc welding is done in dry areas only ....S U NA
14. The electrode holder is maintained and stored in good condition to eliminate possible accidental arcs ....S U NA
15. ______________________________ S U NA
16. ______________________________ S U NA

D. ELECTRICAL INSTALLATION

1. All electrical boxes are enclosed ....S U NA
2. All electrical extension cords are in safe condition and are not carrying excessive loads or used as permanent circuits ....S U NA
3. Extension cords, three-wire construction, are used in the laboratory ....S U NA
4. Electrical motors and equipment are wired to comply with the National Electric Code ....S U NA
5. Disconnects are provided for each machine ....S U NA
6. No temporary wiring is in evidence ....S U NA
7. All outlets and machines are grounded electrically ....S U NA
8. Electrical panels are identified properly ....S U NA
9. Safety areas in front of electrical panels are clear ....S U NA
10. Electric kiln complies with National Electric Code ....S U NA
11. Electric kiln location is free of combustible materials ....S U NA
12. ______________________________ S U NA
13. ______________________________ S U NA

E. NATURAL GAS

1. No flex gas hose is used where pipe connections could be made ....S U NA
2. Gas appliances are adjusted so that they may be lighted without undue hazard ....S U NA
3. There are no gas leaks or gas odors detectable in the room ....S U NA
4. Gas-operated equipment (excluding small soldering furnaces) is ignited from an automatic ignition system ....S U NA
5. Automatic temperature and safety controls are installed ....S U NA
6. The main supply cutoff valve is identified, readily accessible, and located outside possible heat and fire areas ....S U NA
7. Nonflammable insulating materials have been installed adjacent to gas appliance ....S U NA
8. Gas kiln complies with Uniform Fire Code ....S U NA
9. Gas kiln location is free of combustible materials ....S U NA
10. Properly designed and constructed equipment is used for handling molten metal when casting ....S U NA
11. ______________________________ S U NA
12. ______________________________ S U NA

F. PERSONAL PROTECTION

1. Goggles, glasses, or protective shields, meeting U.S.A. standards Z87 1.1979, are provided and required for all work where eye hazards exist .... S U NA
2. If individual eye protective devices are provided, they are disinfected properly before use .... S U NA
3. Shields and goggles are provided where needed .... S U NA
4. Rings and other jewelry are removed by pupils when working with machine tools .... S U NA
5. Approved wearing apparel, including shoes, is worn .... S U NA
6. Specialized apparel such as leggins, aprons, etc. are provided by the school and are worn in classes such as welding and foundry .... S U NA
7. Eye wash stations and showers are available when using caustic materials or chemicals .... S U NA
8. Pupil's clothing is free of loose sleeves, flopping ties, loose coats, etc. .... S U NA
9. Pupil's hair is short or fastened behind the head when using machines .... S U NA
10. The sterilizing units in the germicidal cabinets operate properly and eye protective devices are well maintained .... S U NA
11. ____________________ S U NA
12. ____________________ S U NA

G. INSTRUCTION

1. Safety is taught as an integral part of each teaching unit .... S U NA
2. Safety rules are posted particularly at each danger station .... S U NA
3. Printed safety rules are given to each pupil .... S U NA
4. A general laboratory safety test is issued to each pupil. The completed test is signed by the pupil and kept on file .... S U NA
5. A safety test on each machine tool used in the laboratory must be passed by each pupil. The completed test is signed by the pupil and kept on file .... S U NA
6. ____________________ S U NA
7. ____________________ S U NA

H. FIRST AID

1. The school has qualified individuals to administer first aid .... S U NA
2. A first aid cabinet is provided and supplies are restocked periodically .... S U NA
3. ____________________ S U NA
4. ____________________ S U NA

RECOMMENDATIONS

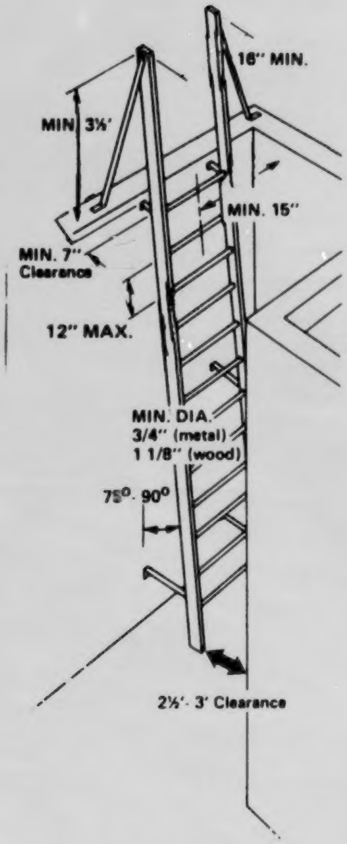
School ____________________ Room ____________________ Date ____________________

Teacher ____________________ Inspected By ____________________

Code No.	

LADDER EXTENSIONS

The side rails of through or sidestep ladder extensions shall extend three and one half (3 1/2) feet above parapets and landings. For through ladder extensions, the rungs shall be omitted from the extension and shall have not less than 18, nor more than 24, inches clearance between rails. For sidestep or offset fixed ladder sections, at the landings, the side rails and rungs shall be carried to the next regular rung beyond or above the three and one half (3 1/2) feet minimum.



GRAB BARS

Grab bars shall be spaced by a continuation of the rung spacing when they are located in the horizontal position. Vertical grab bars shall have the same spacing as the ladder side rails. Grab bar diameters shall be the equivalent of the round rung diameters.

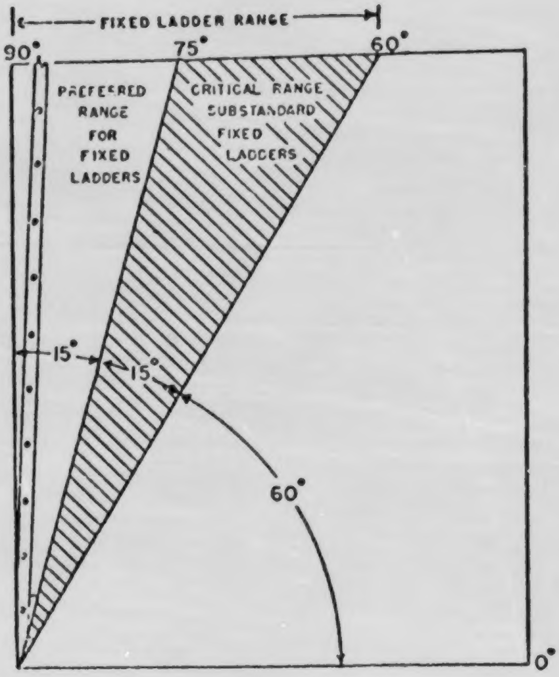
LADDER SAFETY DEVICES

Ladder safety devices may be used on tower, water tank, and chimney ladders that are over 20 feet in unbroken length, in lieu of cage protection. No landing platform is required in these cases. All ladder safety devices (i.e. those that incorporate lifebelts, friction brakes, and sliding attachments) shall meet the design requirements of the ladders which they serve.

PITCH

PREFERRED PITCH--The preferred pitch of fixed ladders shall be considered to come in the range of 75 degrees and 90 degrees with the horizontal.

SUBSTANDARD PITCH--Fixed ladders shall be considered as substandard if they are installed within the substandard pitch range of 60 and 75 degrees. With the horizontal, substandard fixed ladders are permitted only where it is found necessary to meet the conditions of installation. This substandard pitch range shall be considered as a critical range to be avoided, if possible.


FIXED LADDER RANGE
90°
75°
60°
PREFERRED RANGE FOR FIXED LADDERS
CRITICAL RANGE SUBSTANDARD FIXED LADDERS
15°
15°
60°
0°

PITCH OF FIXED LADDERS

MAINTENANCE

All ladders shall be maintained in a safe condition. All ladders shall be inspected regularly, with the intervals between inspections being determined by use and exposure.

PORTABLE LADDERS (OSHA/NIOSH)

PORTABLE WOOD LADDERS

This section is intended to prescribe rules and establish minimum requirements for the construction, care, and use of the common types of portable wood ladders, in order to insure safety under normal conditions of usage.

LADDER CODES--Codes have been established by the American National Standards Institute (ANSI) that cover wood stepladders and extension ladders. Any stepladder or extension ladder with an ANSI seal conforms to the code for wood ladders.

MATERIALS--The following requirements are applicable to all wood parts. They shall be free from sharp edges and splinters; and they shall be sound and free (by accepted visual inspection) from shake, wane, compression failures, decay, or other irregularities. Low-density wood shall not be used.

PORTABLE STEPLADDERS

Stepladders longer than 20 feet shall not be supplied. Stepladders as hereinafter specified shall be of three types.

1. TYPE I - Industrial stepladder; 3 to 20 feet for heavy duty (such as those used by utilities, contractors, and industry).
2. TYPE II - Commercial stepladder; 3 to 12 feet for medium duty (such as those used by painters, offices, and light industry).
3. TYPE III - Household stepladder; 3 to 6 feet for light duty (such as light household use).

GENERAL REQUIREMENTS

1. A uniform step spacing shall be employed which shall be not more than 12 inches. The steps shall be parallel and level when the ladder is in a position for use.

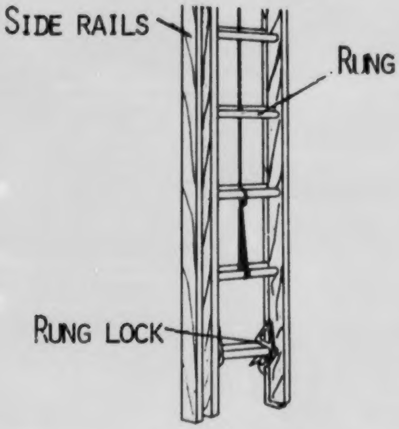
2. The minimum width between side rails at the top, inside to inside, shall be not less than 11 1/2 inches. From top to bottom, the side rails shall spread at least one inch for each foot of length of the stepladder.

3. A metal spreader, or locking device of sufficient size and strength to securely hold the front and back sections in open positions, shall be a component of each stepladder. The spreader shall have all its sharp points covered or removed to protect the user. For a Type III ladder, the pail shelf and spreader may be combined in one unit.

TYPE III LADDERS

SINGLE LADDER--Single ladders longer than 30 feet shall not be supplied.

TWO-SECTION LADDER--Two-section extension ladders longer than 60 feet shall not be supplied. All ladders of this type shall consist of two sections; one to fit within the side rails of the other, and both arranged in such a manner that the upper section can be raised and lowered.



SECTIONAL LADDER--Assembled combinations of sectional ladders longer than the lengths specified in this subdivision shall not be used.

TRESTLE AND EXTENSION TRESTLE LADDER--Trestle ladders, extension sections, or base sections of extension trestle ladders longer than 20 feet shall not be supplied.

PAINTER'S STEPLADDER--Painter's stepladders longer than 12 feet shall not be supplied.

MASON'S LADDER--A mason's ladder is a special type of single ladder intended for use in heavy construction work. Mason's ladders longer than 40 feet shall not be supplied.

TROLLEY AND SIDE-ROLLING LADDERS--Trolley ladders and side-rolling ladders longer than 20 feet shall not be supplied.

CARE OF LADDERS

1. Ladders shall be maintained in good condition at all times. The joint between the steps and side rails shall be tight, all hardware and fittings shall be securely attached, and the movable parts shall operate freely without binding or undue play.

2. Metal bearings of locks, wheels, pulleys, etc., shall be frequently lubricated.

3. Frayed or badly worn rope shall be replaced.

4. Safety feet and other auxiliary equipments shall be kept in good condition to insure proper performance.

5. Ladders shall be inspected frequently and those which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "Dangerous-Do Not Use."

6. Rungs should be kept free of grease and oil.

USE OF LADDERS

1. Portable rung and cleat ladders shall, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one quarter of the working length of the ladder (the length along the ladder between the foot and top support). The ladder shall be so placed as to prevent slipping, or it shall be lashed or held in position. Ladders shall not be used in a horizontal position as platforms, runways, or scaffolds.

2. Ladders for which dimensions are specified shall not be used by more than one person at a time, nor with ladder jacks and scaffold planks where use by more than one person is anticipated. In such cases, specially designed ladders with larger dimensions of the parts should be procured.

3. Portable ladders shall be so placed that the side rails have a secure footing. The top rest for portable rung and cleat ladders shall be reasonably rigid and shall have ample strength to support the applied load.

4. Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked open, locked, or guarded.

5. Ladders shall not be placed on boxes, barrels, or other unstable bases in order to obtain additional height.

6. To support the top of the ladder at a window opening, a board shall be attached across the back of the ladder, extending across the window and providing firm support against the building walls or window frames.

7. When ascending or descending, the user shall face the ladder.

8. Ladders with broken or missing steps, rungs, or cleats; broken side rails; or other faulty equipment shall not be used. Improvised repairs shall not be made.

9. Short ladders shall not be spliced together to provide long sections.

10. Ladders made by fastening cleats across a single rail shall not be used.

11. Ladders shall not be used as guys, braces, or skids; or for other than their intended purposes.

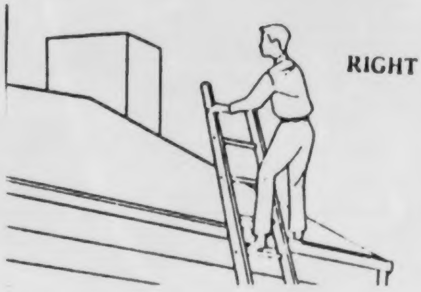
12. The tops of the ordinary types of stepladders shall not be used as steps.

13. On two-section extension ladders, the minimum overlap for the two sections in use shall be as follows:

Size of Ladder (Feet)	Overlap feet
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

14. Portable rung ladders with reinforce rails shall be used only with the metal reinforcement of the underside. Ladders of this type should be used with great care near electrical conductors, since the reinforcing itself is a good conductor.

15. No ladder shall be used to gain access to a roof unless the top of the ladder shall extend at least three feet above the point of support; at the eave, gutter, or roof line.



16. Adjustment of extension ladders shall be made only by the user. This is to be done when standing at the base of the ladder, so that the user may see that the locks are properly engaged. Adjustment of extension ladders from the top of the ladder (or any level over the locking device) is a dangerous practice and should not be attempted. Adjustment should not be made while the user is standing on the ladder.

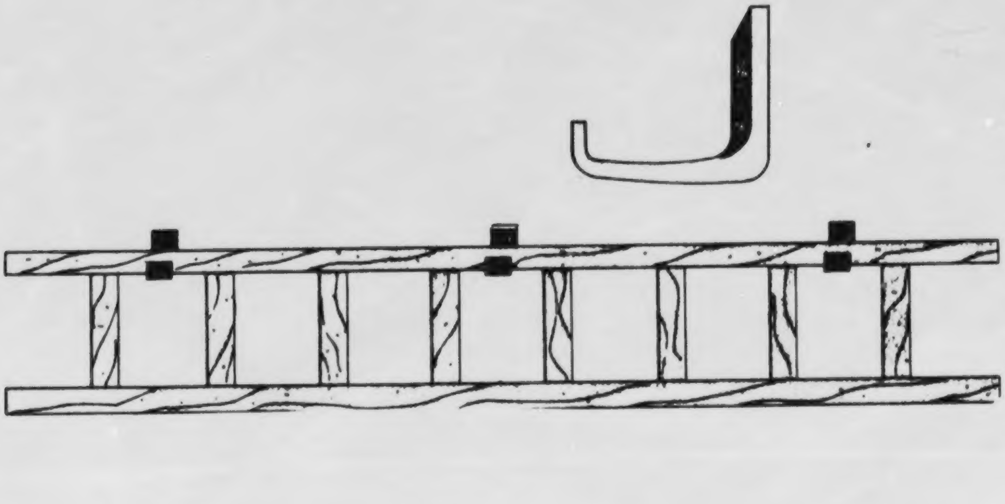
17. The middle and top sections of sectional or window cleaner's ladders shall not be used for the bottom section unless the user equips them with safety shoes.

18. Extension ladders shall always be erected so that the upper section is resting on the bottom section.

19. The user should equip all portable rung ladders with nonslip bases when there is a hazard of slipping. Nonslip bases are not intended as a substitute for care in the safe placing, lashing, or holding of a ladder that is being used upon oily, metal, concrete, or slippery surfaces.

20. The bracing on the back legs of stepladders is designed solely for increasing stability and not for climbing.

21. Hangers should be used for storing ladders horizontally in order to prevent sag and permanent set. At least three should be used for each ladder.



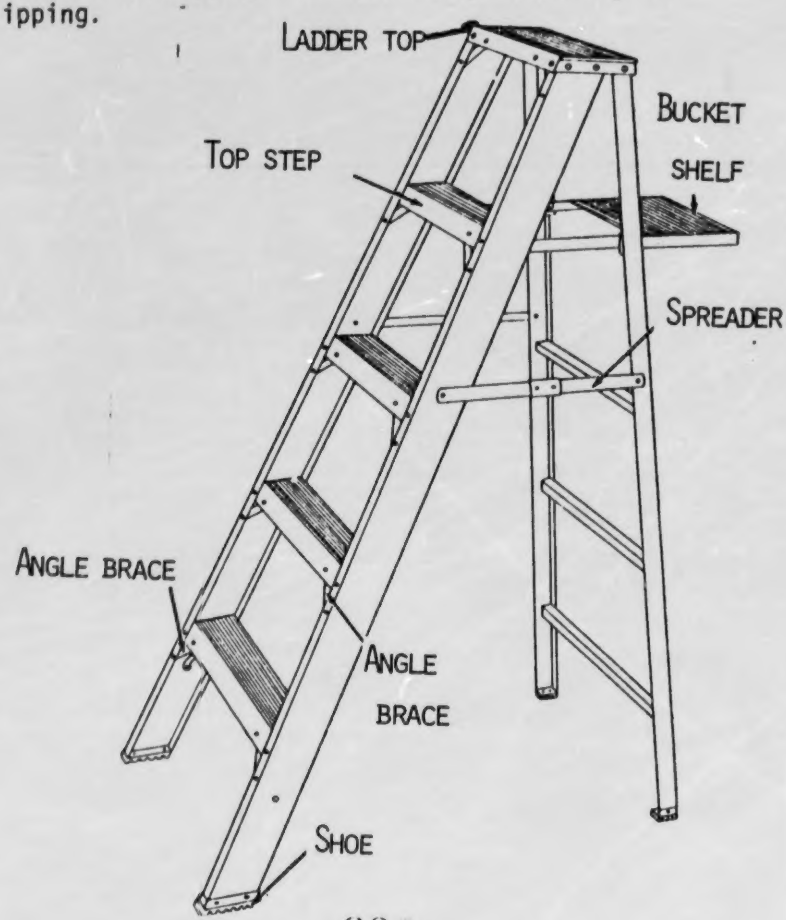
PORTABLE METAL LADDERS (OSHA/NIOSH)

SPECIFIC DESIGN AND CONSTRUCTION

1. Requirements are not part of this section because of the wide variety of metals and design possibilities. However, the design shall be such as to produce a ladder without structural defects or accident hazards --such as sharp edges, burrs, etc. The metal selected shall be of sufficient strength to meet the test requirements, and shall be protected against corrosion unless it's inherently corrosion-resistant.

2. The spacing of rungs or steps shall be on 12 inch centers.

3. Rungs and steps shall be corrugated, knurled, dimpled, or coated with skid-resistant material; or shall be otherwise treated to minimize the possibility of slipping.



STRAIGHT AND EXTENSION LADDERS

1. The minimum width between the side rails of a straight ladder, or any section of an extension ladder, shall be 12 inches.

2. The length of single ladders, or individual sections of ladders, shall not exceed 30 feet. Two-section ladders shall not exceed 48 feet in length, and over two-section ladders shall not exceed 60 feet in length.

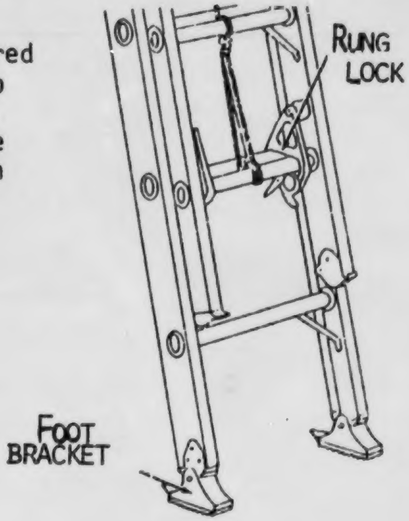
3. Based on the nominal length of the ladder, each section of a multi-section ladder shall overlap the adjacent section by at least the number of feet stated in the following:

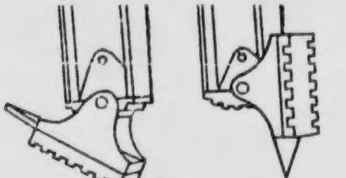
Nominal Length of Ladder	Overlap Feet
Up to and including 36	8
Over 36, up to and including 48	4
Over 48 up to 60	5

4. Extension ladders shall be equipped with positive stops which will insure the overlap specified in the table above.

5. The length of a stepladder is measured by the length of the front rail. To be classified as a standard length ladder, the measured length shall be within a plus or minus one half inch of the specified length. Stepladders shall not exceed 20 feet in length.

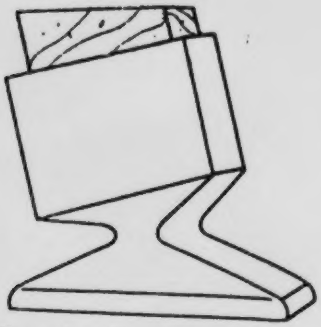
6. The bottoms of the four rails are to be supplied with insulating nonslip material for the safety of the user.



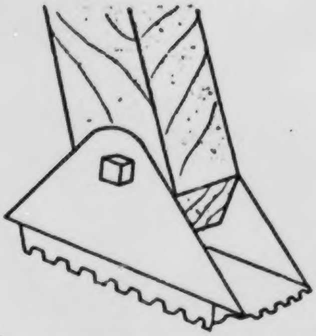


SAFETY SHOE

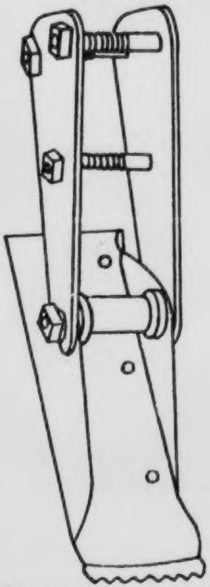
7. Safety shoes should be attached to all metal ladders and to all wood ladders used in slippery or wet places. Although metal ladders are usually sold equipped with safety shoes, wear may make replacement necessary. Shoes for wood ladders are usually bought as accessory items.



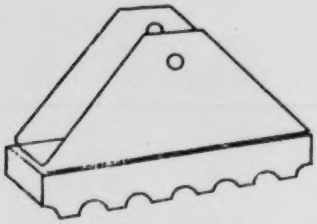
RUBBER SHOE FOR WOOD EXTENSION LADDER



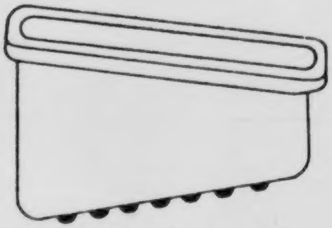
FOR WOOD EXTENSION LADDER



FOR METAL EXTENSION LADDER



FOR METAL STEPLADDER



RUBBER SHOE FOR EITHER WOOD OR METAL STEPLADDER

8. A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component of each stepladder. The spreader shall have all the sharp points or edges covered or removed to protect the user.

9. The length of a platform ladder shall not exceed 20 feet and shall be measured along the front rail from the floor to the platform.

CARE AND MAINTENANCE OF LADDERS

1. To get the maximum serviceability and safety, and to eliminate any unnecessary damage of equipment, good safe practices in the use and care of ladder equipment shall be employed by the users.

2. Ladders shall be maintained in good usable condition at all times. Hardware fittings and accessories should be checked frequently and kept in good working condition.

3. Ropes or cables shall be inspected frequently and replaced if defective.

4. Complete ladder inspection should be periodical. If a ladder is involved in any of the following, an immediate inspection is necessary:

   A. If a ladder tips over, inspect the ladder for side rails dents or bends, or excessively dented rungs; check all of the rung-to-side-rail connections; check the hardware connections; and check the rivets for shear.

   B. If a ladder is exposed to excessive heat (as in the case of fire), the ladder should be inspected visually for damage and tested for deflection and its characteristics. In doubtful cases, refer to the manufacturer's instructions.

   C. If a ladder is to be subjected to certain acid or alkali solutions, a protective coating such as asphalt and varnish should be applied to it.

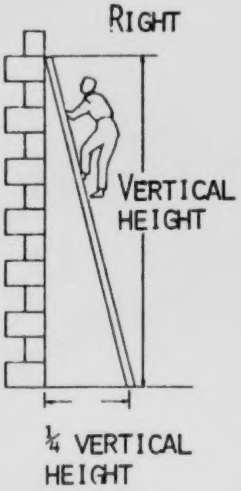
   D. If a ladder is exposed to oil and grease, it should be cleaned of the oil, grease, or other slippery materials. This can easily be done with a solvent or by steam cleaning.

   E. Ladders having defects are to be marked and taken out of service until repaired by either the maintenance department or the manufacturer.

USE OF LADDERS

1. Portable nonself-supporting ladders should be erected at a pitch of 75 1/2 degrees for maximum balance and strength. A simple rule for setting up a ladder at the proper angle is to place the base a distance from the vertical wall equal to one fourth the working length of the ladder.

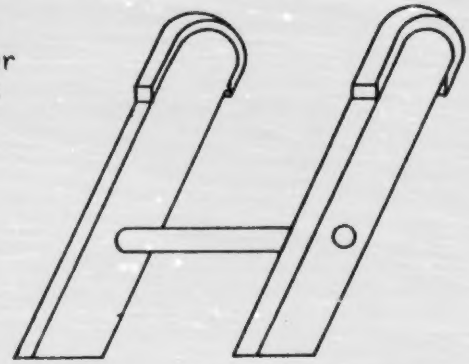
2. Portable ladders are designed to be one-man working ladders, based on a 200 pound load.



3. The ladder base section must be so it has a secure footing. Safety shoes of good substantial design should be installed on all ladders. Where ladders without safety shoes or spikes are used on hard, slick surfaces, a foot ladder board should be employed.

4. The top of the ladders shall be placed with the two rails supported, unless it is equipped with a single support attachment. Such an attachment should be substantial and large enough to support the ladder under a load.

5. Rubber or plastic strips can be attached to the tops of extension ladder side rails. These strips keep the top of a ladder from slipping on the surface it leans against.



6. When ascending or descending, the climber shall face the ladder.

7. Ladders shall not be tied or fastened together to provide longer sections. They must be equipped with the necessary hardware fittings if the manufacturer endorses an extended use.

8. Ladders shall not be used as a brace, skip, guy or gin pole, gangway, or for uses other than those for which they are intended; unless such uses are specifically recommended by the manufacturer.

9. Users are cautioned to take the proper safety measures when metal ladders are used in areas containing electric circuits in order to prevent short circuits or electrical shocks.

STOREROOMS

1. For the storage of flammable liquids, one should always read labels. Examples of such liquids are duplicating fluid, thinners, oil base paints, etc. (See Unit 12, "Storage Cabinets".)

2. Tall storage shelves should be anchored to the wall to prevent tipping. Shelves must not be overloaded.

3. Storage rooms with electrical panels, switchgear, or wall outlets should maintain clear access to electrical at all times.

4. When materials are stored in tiers, a height must be maintained to assure a stable condition.

5. All containers shall be kept closed when not in use.

6. In storerooms with shelving installed to ceiling height (particularly those which are in constant use), a rolling ladder might be safer than a standard portable ladder.

7. In storerooms having mechanical equipment a safe clearance from the mechanical equipment shall be maintained.

8. In storerooms having gas-fired equipment the storage regulations enforced by the fire inspection department should be followed.

9. If the storeroom has sprinkler protection, 18 inches of clearance must be maintained between the sprinkler head and the top of storage.

10. Housekeeping storage areas shall be kept free from the accumulation of materials that will constitute a hazard from tripping, fire, explosion, or pest harborage.

WALKING AND WORKING SURFACES

(OSHA/NIOSH)

GENERAL REQUIREMENTS

1. The workplace must be maintained clean, orderly, sanitary, and as far as possible, in a dry condition. Spills should be cleaned up promptly.

2. Areas which are constantly wet should have nonslip surfaces where personnel normally walk or work.

3. Every floor, working place, and passageway must be maintained free from protruding nails, splinters, holes, and loose boards.

4. All permanent aisles must be easily recognizable, be maintained to allow clear passage, and provide sufficient clearance for traffic and materials handling equipment.

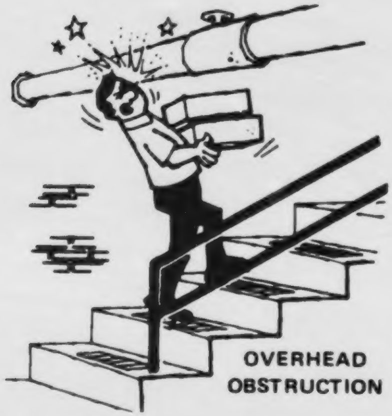
5. The floor load capacity is the maximum weight which can be safely supported by the floor, expressed in pounds per square foot. Floor load capacities must be posted in a readily visible location (except for slab floors with no basements). When this information is not available, and when floor load capacity is in doubt, it is suggested that a competent engineer be consulted.

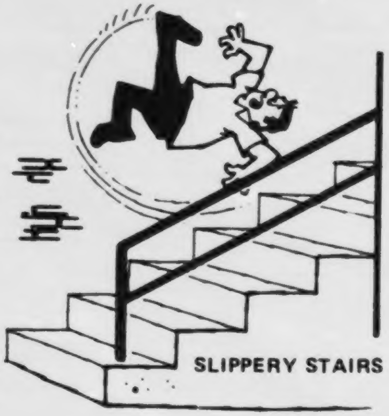
Fixed Industrial Stairs (OSHA/NIOSH)

1. Riser height and tread width must be uniform throughout any flight of stairs.

2. All treads must be reasonable slip resistant.

3. Vertical clearance above any stair tread to any overhead obstruction must be at least 7 feet, measured from the leading edge of the tread.





4. The minimum permissible width is 22 inches (if a means of exit access, at least 28 inches).

5. The angle to the horizontal made by the stairs must be between 30 degrees and 50 degrees.

6. All stairs should be adequately lighted.

7. If the tread is less than 9 inches wide, the risers should be open.

8. If the flight of stairs has 4 or more risers:

    A. A stair railing on each open side is required.

    B. A hand rail on each enclosed side is required if greater than 44 inches.

    C. And both sides are enclosed on a stairway less than 44 inches wide, at least one handrail is required, preferably on the right side descending.

    D. And if the stairway is 88 or more inches wide, an intermediate stair railing located midway is required.

9. The vertical height of the railing must be 30 to 34 inches and of construction similar to the standard guard railing described later in this section.

AISLES AND PASSAGEWAYS

Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways, and wherever turns and passage must be made. Aisles and passageways shall be kept clear and in good repair, with no obstructions across or in the aisles that could create a hazard. Permanent aisles and passageways shall be appropriately marked.(OSHA)

PROTECTION FOR FLOOR OPENINGS

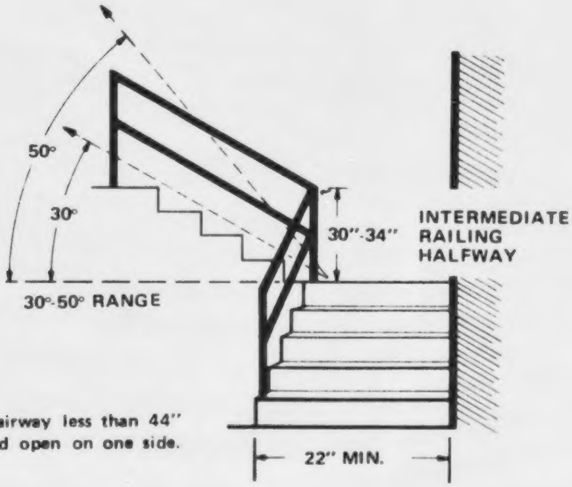
Every manhole floor opening shall be guarded by a standard manhole cover which need not be hinged in place. While the cover is not in place, the manhole opening shall be constantly attended by someone or shall be protected by removable standard railings.

Every floor hole into which a person can accidentally walk shall be guarded by either:

1. A standard railing with standard toeboard on all exposed sides, or

2. A floor hole cover of standard strength and construction that should be hinged in place.

THE STANDARD GUARD RAILING AND TOEBOARD



Stairway less than 44" and open on one side.

A STANDARD GUARD RAILING--consists of a top rail, intermediate rail, and posts. The distance from the upper surface of the top rail to the floor, platform, runway, or ramp must be 42 inches. The intermediate rail must be approximately halfway between the top rail and the floor.

A standard guard railing can be of any configuration and construction that meets the basic dimension requirements (42 inches high and midrail) and can withstand 200 pounds applied in any direction at any point on the top rail. For wood railings, the rail and posts must be at least 2" x 4" stock with posts spaced not more than 6 feet.

For structural steel railings, posts and rails must be of 2 x 2 x 3/8 inch angles or other metal shapes of equivalent strength with posts spaced not more than 8 feet.

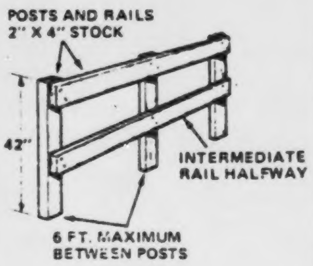
The STANDARD TOEBOARD must be approximately 4 inches in height from the floor to its top edge, with no more than a 1/4 inch gap between the toeboard and the floor. It may be constructed of any substantial material either solid or perforated, as long as the openings are smaller than 1 inch.

WHERE A STANDARD GUARD RAIL IS REQUIRED

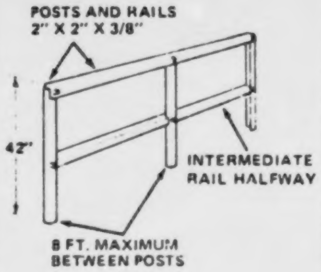
1. Every open-sided floor or platform 4 feet or more above the adjacent floor or ground level must be railed on all open sides except where there is entrance to a ramp, stairway, or fixed ladder.
2. Every stairway floor opening must be guarded on all exposed sides except the entrance to the stairway.
3. Every ladderway floor opening must be guarded by a standard railing and toeboard on all sides, with passage through the railing constructed so as to prevent a person from walking directly into the opening.
4. Every runway or catwalk 4 feet or more above ground or floor level must have railings on all open sides.

As a general condition: a standard toeboard and railing are required wherever people walk beneath the open sides of a platform or under similar structures or where things could fall from the structure.

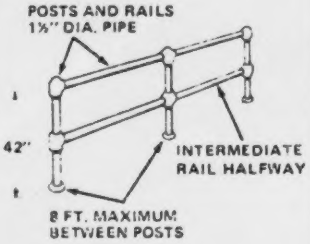
WOOD RAILS


POSTS AND RAILS
2" X 4" STOCK
42"
INTERMEDIATE
RAIL HALFWAY
6 FT. MAXIMUM
BETWEEN POSTS

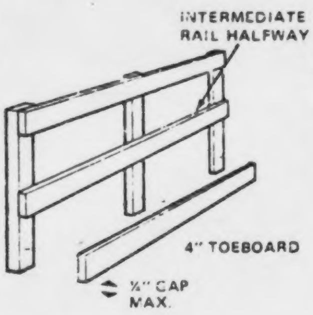
STRUCTURAL STEEL


POSTS AND RAILS
2" X 2" X 3/8"
42"
INTERMEDIATE
RAIL HALFWAY
8 FT. MAXIMUM
BETWEEN POSTS

PIPES


POSTS AND RAILS
1½" DIA. PIPE
42"
INTERMEDIATE
RAIL HALFWAY
8 FT. MAXIMUM
BETWEEN POSTS

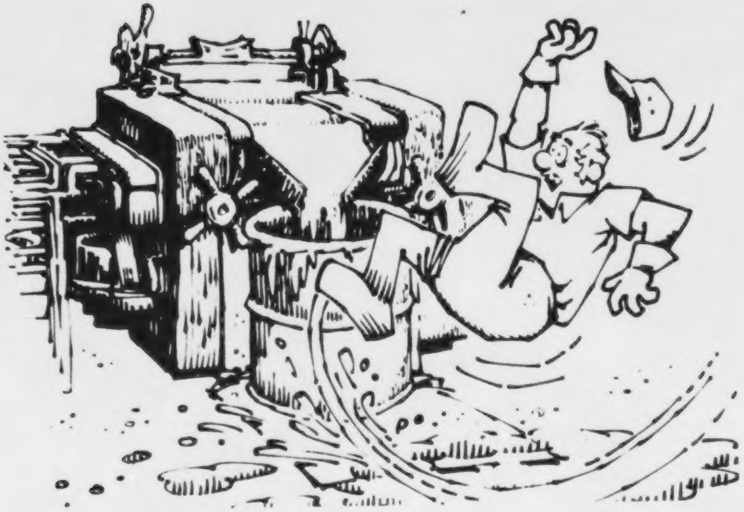
TOEBOARDS


INTERMEDIATE
RAIL HALFWAY
4" TOEBOARD
¼" GAP
MAX.

COVERS

The construction of floor opening covers may be of any material that meets the strength requirements. Covers projecting not more than one inch above the floor level may be used, providing all edges are chamfered to an angle with the horizontal of not more than 30 degrees. All hinges, handles, balls, or other parts shall be flush with the floor or cover surface.

TRIPS, SLIPS, AND FALLS



The falls taken by many people are a major source of accidents. People have fallen from considerable heights and received only minor injuries, while others have fallen from a standing or sitting position and have died from their injuries. This indicates that the seriousness of the injury is a matter of chance. Nearly all falls result from obvious conditions or practices. Preventing such accidents requires the maintaining of safe conditions and controlling the unsafe acts of people. Injury reports indicate that there are several causes of falls, most of which are easily detected.

WHAT CAUSES PEOPLE TO TRIP OR STUMBLE?

TRIPPING-STUMBLING HAZARDS

Objects out of place

Objects or materials in walkways

Tools on the floor

Projecting parts of machines or equipment

Equipment or material on stairs

Scrap or waste materials

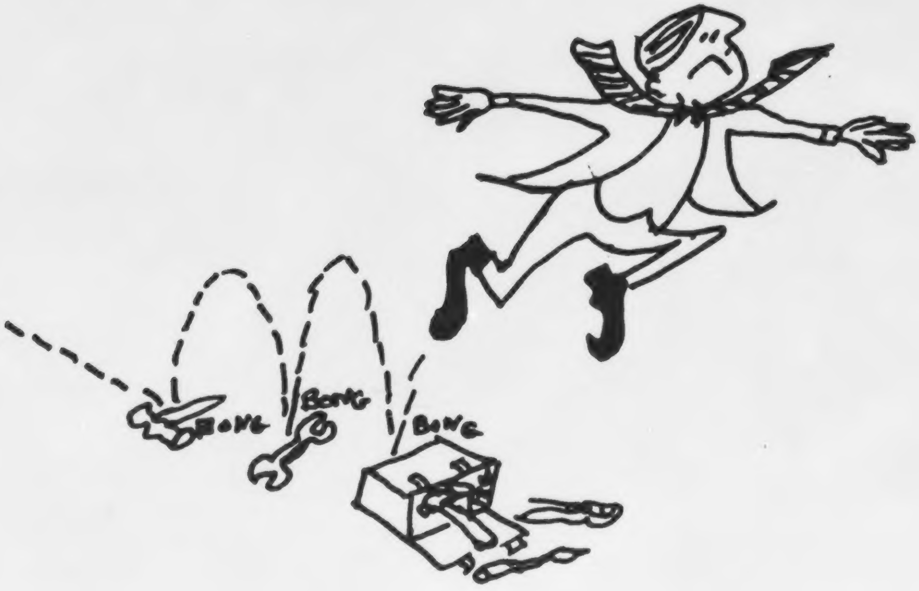
Pipe or conduit set near the floor level

Extension cords, power cables and air hoses

Uneven floor surface:

- Poles and depressions in floor or other walkway
- Projections--warped or loose boards or blocks
- Broken floor surface
- Uneven patches
- Uncovered drains, pits
- Bent floorboards or plates
- Loose or poorly fitted grating
- Sudden changes in pitch or elevation
- Sagging or expanded floor supports

PREVENTING TRIPPING-STUMBLING



SAFE CONDITIONS

Planning and arranging machines, processes, and walk areas to eliminate tripping-stumbling hazards.

Provide placement and storage areas for tools, equipment, and materials.

Prohibit placing or leaving materials, tools, or equipment in areas used for walkways.

Provide for inspection and immediate removal, replacement, or repair of tripping-stumbling hazards.

Maintain good housekeeping.

SAFE WORK METHODS

Employees are--

Required to keep materials, tools, and objects in designated places, and are so instructed.

Given responsiblity for correcting or reporting slipping-stumbling hazards.

Instructed to return tools and equipment to proper place immediately after use.

Instructed to step over or around obstructions--not on them.

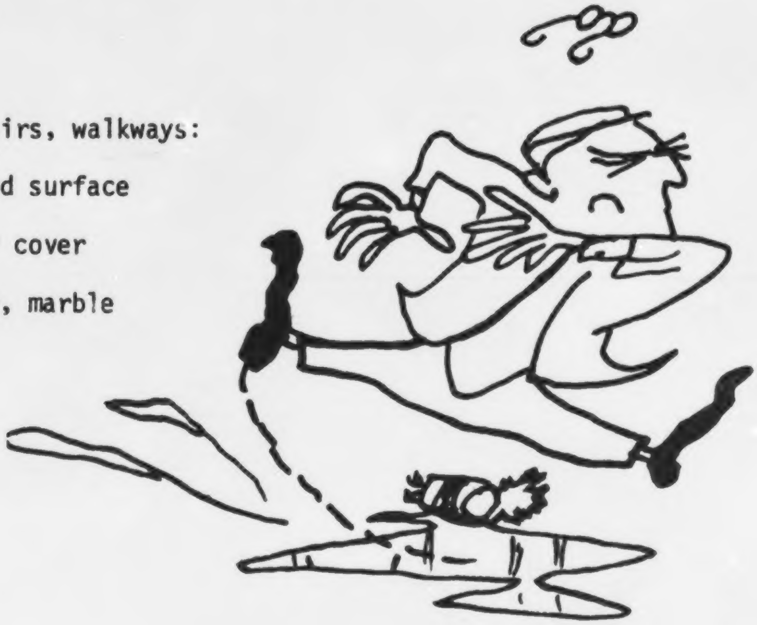
SLIPPING HAZARDS

Wet floors, stairs, walkways:

- Water
- Oil or grease
- Chemicals

Smooth floors, stairs, walkways:

- Waxed, polished surface
- Metal plate or cover
- Tile, terrazzo, marble



PREVENTING SLIPPING

Safe conditions--

Clean up all spills, drips, or leaks immediately.

Correct causes of spills or leaks.

Provide necessary drains, pans, splash guards.

Use only slip-resistant waxes, polishes.

Roughen plates, grills, concrete.

Use nonslip paint mats, treads, or abrasive surfacing.

Provide signs or barriers where uncontrollable or temporary slipping hazard exists.

SAFE WORK METHODS

Employees are instructed to clean up spills immediately and to report leaks, puddles, or other slippery conditions.

Employees to use caution when necessary to walk on slippery surfaces.

(U. S. Department of Labor Safety Training Programs)
OSA-OSHA 183--"Trips, Slips, and Falls"

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

Publications available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 *

American National Standards Institute (ANSI)
1430 Broadway
New York, New York 10018

General Industries, OSHA 2206 (29 CFR 1910)*

H.E.W. Publication (NIOSH 76-170)*

(NIOSH) Publication (76-118)*

(NIOSH) Publication (78-195)*

OSHA 183 (1971)*

SAFETY INSPECTION CHECKLISTS

Since safe conditions depend on vigilance for possible hazards and immediate remedial action, periodic inspections are one of the most important aspects of a successful health and safety program. By using a checklist, such as the ones contained in this publication, the principal, manager, supervisor, teacher, or other support personnel will be able to identify problem areas so that corrective action may be taken.

Sample copies of Safety Inspection Checklists are provided for auxiliary areas by various national, state, and local agencies. Also, Safety Inspection Checklists have been designed and written for each curricular area, and these are contained in the following pages. These reports supply written documentation for evaluating and maintaining facilities and equipment and a guide for budgeting for future improvements.

SAFETY CHECKLIST

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL

CAFETERIA AND FOOD SERVICE AREAS

This checklist is the one followed by OSHA in their inspections of food service establishments. It is found in the NIOSH Health and Safety Guide For Eating and Drinking Places, published by the U.S. Department of Health, Education and Welfare, Public Health Services, Center for Disease Control, Division of Technical Services, Cincinnati, Ohio. May 1976, No. 76-163.

WALKING AND WORKING SURFACES-
(29 CFR 1910.22.27) AISLES AND FLOORS

1. Are all places of employment kept clean and orderly? S U NA
2. Are floors, aisles, and passageways kept clean and dry and all spills cleaned up immediately? S U NA
3. Are floor holes, such as drains covered? S U NA
4. Are wet and/or greasy areas covered with non-slip materials or mats? S U NA
5. Are mats (rubber and wood) in good repair? S U NA
6. Is spilled food cleaned up immediately? S U NA
7. Are broken dishes picked up immediately? S U NA

STORAGE LOFTS, SECOND FLOORS, ETC.

8. Are signs showing floor-load capacity present? S U NA
9. Are platforms, storage lofts, balconies, etc. that are more than 4 feet above the floor protected with standard guardrails? S U NA
10. Are all platforms, lofts, and balconies (above where people or machinery could be exposed to falling objects) also guarded with standard 4-inch toeboards? S U NA

LADDERS

11. Have defective ladders (e.g., with broken rungs or side rails) been tagged as "DANGEROUS, DO NOT USE" and removed from service for repair or destruction? S U NA

12. Is the use of the top step of an ordinary step ladder as a step prohibited? S U NA

13. Do fixed ladders have at least 3½ feet of extension at the top of the landing? S U NA

14. Is the distance between the centerline of rungs on a fixed ladder and the nearest permanent object in back of the ladder at least 7 inches? S U NA

15. Do all fixed ladders have a preferred pitch of 75°-90°? S U NA

STAIRS

16. Are there standard stair rails or handrails on all stairways having 4 or more risers? S U NA

17. Are stairways at least 22 inches wide? S U NA

18. Do stairs have at least a 7-foot overhead clearance? S U NA

19. Do stairs angle no more than 50° and no less than 30°? S U NA

EGRESS (29 CFR 1910.36-.37)

20. Are all exits marked with an exit sign and illuminated by a reliable light source? S U NA

21. Is the lettering at least 6 inches high with the principal letter strokes at least 3/4 of an inch wide? S U NA

22. Is the direction to exits, when not immediately apparent, marked with visible signs? S U NA

23. Are doors or other passageways, that are neither exits nor access to an exit, and located where they may be mistaken for exits, appropriately marked "NOT AN EXIT," "TO BASEMENT," "STOREROOM," etc.? S U NA

24. Are exit doors side-hinged? S U NA

25. Are all doors that must be passed through to reach an exit or way to an exit, always free to access with no possibility of a person's being locked inside? S U NA

26. Are all exit routes always kept free of obstructions? S U NA

OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL (29 CFR 1910.1000)

27. Is management aware of the hazards caused by various materials used (ammonia, drain cleaners, caustics, detergents, etc.)? S U NA

28. Are eye wash fountains provided in areas where corrosive chemicals such as drain cleaners or caustic solutions are used? S U NA

29. Is management aware of the hazards of microwaves, ultraviolet radiation, and heat stress? S U NA

30. Are all containers, such as vats and storage tanks, labeled as to their contents? S U NA

31. Are employees required to wear personal protective equipment when handling hazardous materials to avoid skin and eye contact? S U NA

OCCUPATIONAL NOISE EXPOSURE (29 CFR 1910.95)

32. If a noise problem is suspected, have noise levels been accurately measured? S U NA

33. If a noise problem exists, have plans to reduce noise levels by engineering methods been formulated (e.g., enclosure, maintenance, different methods of processing)? S U NA

34. If engineering controls cannot reduce the noise to safe levels:

    a. have administrative controls, such as limiting worker-exposure in a given area, been started? S U NA

    b. are affected employees given annual audiometric tests, if necessary? S U NA

    c. do all employees in high-noise areas wear hearing protection? S U NA

    d. are annual noise surveys made to reevaluate the problem? S U NA

PERSONAL PROTECTIVE EQUIPMENT
(29 CFR 1910.132-.137)

35. Is personal protective equipment provided, used, and maintained wherever it is necessary? S U NA

36. Is employee-owned personal protective equipment, such as gloves and protective footwear, adequate, and properly maintained? S U NA

37. Is eye and face protection required and used to prevent injury from caustic cleaning materials or flying debris? S U NA

38. When engineering and/or administrative controls are not feasible, are ear plugs or muffs provided and worn during noisy conditions? S U NA

GENERAL ENVIRONMENTAL CONTROLS
SANITARY (29 CFR 1910.141)

39. Are restrooms and washrooms kept in clean and sanitary condition? S U NA

40. Are covered receptacles for sanitary napkins provided in the women's restroom? S U NA

41. Are covered receptacles for waste food kept in clean and sanitary condition? S U NA

42. Has pest control been exercised? S U NA

MEDICAL AND FIRST AID
(29 CFR 1910.151)

43. Is at least one employee on each shift currently qualified to render first aid in the absence of a nearby clinic or hospital? (Some states require first aid trained persons regardless of nearby clinics or hospitals.) S U NA

44. Are first aid supplies readily available, inspected, and replenished? S U NA

45. Are first aid supplies approved by a consulting physician, indicating that they are adequate? S U NA

46. Are medical personnel readily available for advice and consultation on matters of employee health? S U NA

WICHITA ELEMENTARY PHYSICAL EDUCATION SAFETY INSPECTION CHECKLIST

School ______________________________ Date ______________________________

Inspected By ____

Safety should be an essential part of the physical education and athletic program. A safe environment will exist only if hazards are discovered and corrected through regular inspections.

The following is a safety inspection checklist for physical education and athletic environment.

CHECKING PROCEDURE

Draw a circle around the appropriate letters, using the following code.

S — Satisfactory (needs no attention)
U — Unsatisfactory (needs immediate attention)

Respond to all items: X-out if not applicable

Example:

If the school being checked does not have a physical education office, X-out ~~Office~~

If the school being checked has other names or numbers for the areas - change ~~Gym~~ A-1

Recommendations should be made in all cases where a "U" is circled. Space is provided at the end of the form for such comments.

1973

PHYSICAL EDUCATION SAFETY INSPECTION — ELEMENTARY

Circle Response:
S — Satisfactory (needs no attention)
U — Unsatisfactory (needs immediate attention)
X-out if not applicable

	Gym	Gym	Pool	Wrest. Room	Rhythm Room	Wt. Room	Girls' Locker	Boys' Locker	Storage	Hall	Fields & Courts	Oth.
A. GENERAL PHYSICAL CONDITION												
1. Housekeeping in general	S U								S U		S U	S U
2. Floors, walls, windows and ceilings are cleaned periodically	S U								S U		X	S U
3. Ventilation is adequate and proper for conditions	S U								S U		X	S U
4. Temperature control	S U								S U		X	S U
5. Exits - condition of lights	S U								S U		X	S U
6. Number and location of exits are adequate, properly identified and unblocked	S U								S U		X	S U
7. First Aid — adequately stocked cabinet is provided	S U								S U		X	S U
8. Fire Safety — alarms and extinguishers are available	S U								S U		X	S U
9. Fire Doors — not blocked or chained open	S U								S U		X	S U
10. Hot steam pipes — not exposed	S U								S U		X	S U
11. Lockers — general condition	S U								S U		X	S U
12. Rest Room facilities — condition of	S U								S U		X	S U
13. Stairway — general condition	S U								S U		S U	S U
14. Stairway handrails — safe	S U								S U		S U	S U
15. Adequate storage for equipment, etc., not in immediate use	S U								S U		S U	S U
16. Safety is taught as a part of each teaching unit	S U								S U		S U	S U
17. Proper procedures have been formulated for emptying the room of pupils and taking adequate precautions in case of emergency	S U								S U		S U	S U
18. Water Fountain — no broken sharp edges etc.	S U								S U		S U	S U
B. ELECTRICAL SAFETY												
1. Electrical equipment and outlets safe	S U								S U		S U	S U
2. Electric panels kept clear	S U								S U		X	S U
3. Fan Guards — must not have over a ¼" opening	S U								S U		X	S U
4. Extension Cords — should not be used as permanent wiring	S U								S U		S U	S U
5. Protecting Light Globes — over incandescent bulbs	S U								S U		X	S U
6. Illumination is safe, sufficient and well placed	S U								S U		S U	S U
7. Score Boards and Console	S U								S U		X	S U
8.	S U								S U		S U	S U
9.	S U								S U		S U	S U
10. Evaluation for the total rating — B — Electrical Safety	S U								S U		S U	S U

1974

	Gym	Gym	Pool	Wrestl Room	Rhythm Room	Wt Room	Girls' Locker	Boys' Locker	Storage	Hall	Fields & Courts	Off
C. EQUIPMENT AND FURNITURE												
1. Equipment or Furniture — arranged so as to conform to good safety	S U								S U		S U	S U
2. Equipment stored properly	S U								S U		S U	S U
3. Furniture in safe working condition	S U								S U		X	S U
4. Bleachers in safe working condition	S U								X		S U	X
5. Benches — general condition — no cracks or splinters	S U								S U		S U	S U
6. Shelves — in safe working condition	S U								S U		X	S U
7. Step Ladders — in safe working condition	S U								S U		X	S U
INDOOR EQUIPMENT in safe working condition												
8. Basketball goals — backstops	S U								X		S U	X
9. Balance Beam	S U								S U		X	X
10. Climbing ropes	S U								X		S U	X
11. Mats and Crash Pads	S U								S U		X	X
12. Vaulting Horse	S U								S U		X	X
13. Volleyball Standards plus cable and pulleys	S U								S U		S U	X
14. Table Tennis Tables	S U								S U		X	X
15. Boxes and Benches	S U								S U		X	X
OUTDOOR EQUIPMENT in safe working condition												
16. Backstops	X								X		S U	X
17. Poles	X								X		S U	X
18. Landing Pits	X								X		S U	X
19. Swings	X								X		S U	X
20. Slide	X								X		S U	X
21. Teeter	X								X		S U	X
22. Ladder	X								X		S U	X
23. Swedish Gym	X								X		S U	X
24. Muscle Man	X								X		S U	X
25. Merry-Go-Round	X								X		S U	X
26. Turning Bar	X								X		S U	X
27. Jungle Gym	X								X		S U	X
28.	X								X		S U	X
29.	X								X		S U	X
30. Evaluation for the total rating — C — Equipment and Furniture	X								X		S U	X

1975

	Gym	Gym	Pool	Wrestl Room	Rhythm Room	Wt Room	Girls' Locker	Boys' Locker	Storage	Hall	Fields & Courts	Oth
D. SURFACES												
1. Condition of floors	S U								S U		X	S U
2. Condition of grounds	X								X		S U	X
3. Condition of hard surface area	X								X		X	X
4. Condition of walls	S U								S U		X	S U
5. Walls are clear of objects that might fall or be unsafe obstructions	S U								S U		X	S U
6. Gym Dividers — condition of curtain or folding doors	S U								X		X	X
7. Crash pads on walls if necessary	S U								S U		X	X
8. Condition of mirrors	S U								S U		X	S U
9. Condition of windows	S U								S U		X	S U
10. Condition of ceiling	S U								S U		X	S U
11. Condition of fences	X								X		S U	X
12.	S U								S U		S U	S U
13.	S U								S U		S U	S U
14. Evaluation for the total rating — D — SURFACES	S U								S U		S U	S U

ELEMENTARY PHYSICAL EDUCATION ATHLETIC SAFETY INSPECTION

School ______________________ Date ______________________

Inspected By ______________________

AREAS NEEDING CORRECTION

Code No.	Area	Recommendations
Example: A — 14	A-1	Handrails are lose and have splinters

1976

WICHITA SECONDARY PHYSICAL EDUCATION SAFETY INSPECTION CHECKLIST

School ______________________________ Date ______________________________

Inspected By ____

Safety should be an essential part of the physical education and athletic program. A safe environment will exist only if hazards are discovered and corrected through regular inspections.

The following is a safety inspection checklist for physical education and athletic environment.

CHECKING PROCEDURE

Draw a circle around the appropriate letters, using the following code.

S — Satisfactory (needs no attention)
U — Unsatisfactory (needs immediate attention)

Respond to all items: X-out if not applicable

Example:

If the school being checked does not have a swim pool X-out ~~Pool~~.

If the school being checked has other names or numbers for the areas - change ~~Gym~~ A-1

Recommendations should be made in all cases where a "U" is circled. Space is provided at the end of the form for such comments.

1977

SECONDARY PHYSICAL EDUCATION AND ATHLETIC SAFETY INSPECTION

Circle Response:
S — Satisfactory (needs no attention)
U — Unsatisfactory (needs immediate attention)
X — out if not applicable

A. BLEACHERS — BENCHES	Gym	Gym	Pool	Wrest Room	Rhythm Room	Wt Room	Girls' Locker	Boys' Locker	Storage	Hall	Fields Courts	Off
1. Bleachers - with open ends - has guard or handrail	S U	S U	S U	X	X	X	X	X	X	X	S U	X
2. Folding Bleachers - permanent benches (no bolts or braces missing	S U	S U	S U	S U	S U	S U	S U	S U	X	X	S U	X
3. Condition of seats & floor boards (no cracks or splinters)	S U	S U	S U	S U	S U	S U	S U	S U	X	X	S U	X
4. Aisles clear and/or identified	S U	S U	S U	X	X	X	S U	S U	S U	X	S U	X
5. Balcony Rails - condition	S U	S U	X	X	X	X	X	X	X	X	X	X
6. Condition of free standing benches	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U	S U
7.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
8.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
9.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
10. Evaluation for the total rating for - A - BLEACHERS - BENCHES	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U	S U

B. ELECTRICAL SAFETY	Gym	Gym	Pool	Wrest Room	Rhythm Room	Wt Room	Girls' Locker	Boys' Locker	Storage	Hall	Fields Courts	Off
1. Electrical equipment and outlets safe	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
2. Electric panels - kept clear	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
3. Fan Guards - must not have over a ½" opening	S U	S U	X	S U	S U	S U	S U	S U	S U	S U	X	S U
4. Extension Cords - should not be used as permanent wiring	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
5. Protecting Light Globes - over incandescent bulbs	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
6. Swim pool - electric safety	X	X	S U	X	X	X	X	X	X	X	X	X
7. Whirlpool - electric safety	X	X	X	X	X	S U	S U	S U	X	X	X	X
8. Hair Dryers - safety	X	X	X	X	X	X	S U	S U	X	X	X	X
9. Illumination is safe, sufficient and well placed	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
10. Score Boards and console	S U	S U	S U	S U	S U	X	X	X	X	X	S U	X
11. Auxiliary Lighting	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
12.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
13.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
14.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
15. Evaluation for the total rating for - B - ELECTRICAL - SAFETY	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U

1978

	Gym	Gym	Pool	Wrest Room	Rhythm Room	Wt Room	Girls Locker	Boys Locker	Storage	Hall	Fields & Courts	Off-
C. EQUIPMENT — FURNITURE												
1 Equipment or furniture are arranged so as to conform to good safety	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
2 Equipment stored properly	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U	S U
3 Equipment or furniture in safe working condition	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
Archery-tackle	S U	S U	X	X	X	X	X	X	S U	X	S U	X
Basketball-goals, backstops, toss back	S U	S U	X	X	X	X	X	X	X	X	S U	X
Field Hockey-equipment	S U	S U	X	X	X	X	X	X	S U	X	S U	X
Football-dummies, sled, film stand	X	X	X	X	X	X	X	X	S U	X	S U	X
Gymnastics-Balance Beam	S U	S U	X	X	X	S U	X	X	X	S U	X	X
Climbing ropes	S U	S U	S U	S U	S U	S U	X	X	X	X	X	X
Horizontal Bar	S U	S U	X	S U	S U	S U	X	X	S U	X	S U	X
Mats-crash pads	S U	S U	X	S U	S U	S U	X	X	S U	X	X	X
Parallel bars	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Side horse	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Spotting rig	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Spotting belt	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Rings	S U	S U	X	X	S U	X	X	X	X	X	X	X
Take-off board	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Trampoline	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Unevens	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Vaulting-buck	S U	S U	X	X	S U	X	X	X	S U	X	X	X
Swim-Diving board	X	X	S U	X	X	X	X	X	X	X	X	X
Kick boards	X	X	S U	X	X	X	X	X	S U	X	X	X
Lane lines	X	X	S U	X	X	X	X	X	X	X	X	X
Ring buoy	X	X	S U	X	X	X	X	X	X	X	X	X
Sheperds crook	X	X	S U	X	X	X	X	X	X	X	X	X
Starting blocks	X	X	S U	X	X	X	X	X	X	X	X	X
Table Tennis-Tables	S U	S U	X	S U	S U	X	X	X	S U	S U	X	X
Track hurdles	X	X	X	X	X	X	X	X	S U	X	S U	X
High jump standards	X	X	X	X	X	X	X	X	S U	X	S U	X
Pole vaulting standards	X	X	X	X	X	X	X	X	S U	X	S U	X

	[illegible]	Gym	Pool	Wrestl Room	Rhythms Room	Wt Room	Girls Locker	Boys Locker	Storage	Hall	Fields & Courts	Off
Landing pits	X	X	X	X	X	X	X	X	S U	X	S U	X
Timers stand	X	X	X	X	X	X	X	X	S U	X	S U	X
Volleyball · Badminton standards	S U	S U	X	X	X	X	X	X	S U	X	X	X
Officials stand	S U	S U	X	X	X	X	X	X	S U	X	X	X
Cables pulleys	S U	S U	X	X	X	X	X	X	S U	X	X	X
Weights · Machine	X	X	X	X	X	S U	X	X	X	X	X	X
Barbells	X	X	X	X	X	S U	X	X	X	X	X	X
Misc · Ladders	X	X	S U	X	X	X	X	X	S U	X	X	X
Shelves	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
D. GENERAL PHYSICAL CONDITION												
1 Housekeeping in general	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
2 Floors, walls, windows, and ceilings are cleaned periodically	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
3 Ventilation - is adequate and proper for conditions	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
4 Temperature control	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
5 Exits - condition of exit lights	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
6 Number and location of exits are adequate, properly identified and unblocked	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
7 Fire safety - alarms and extinguishers available	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
8 Fire doors - not blocked or chained open	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
9 Lockers - general condition	X	X	X	X	X	S U	S U	S U	S U	X	X	S U
10 Lockers are inspected regularly for cleanliness & safety.	X	X	X	X	X	S U	S U	S U	S U	X	X	S U
11 Stairway - general condition	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X
12 Stairway handrails - safe	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X
13 Storage under stairways	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X
14 Storage · foam (jump pits)	X	X	X	X	X	X	X	X	S U	X	S U	X
15 Adequate storage for equipment, etc. not in immediate use	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
16	X	X	X	X	X	X	X	X	X	X	X	X
17 Evaulation for the total rating for · G · GENERAL · PHYSICAL CONDITION	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
E. PERSONAL SAFETY-FIRST AID												
1 An adequately stocked first aid cabinet is provided	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U	S U
2. Safety is taught as a part of each teaching unit	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
3. Swim pool - safety rules available	X	X	S U	X	X	X	S U	S U	X	X	X	X
4. Gymnastics - safety rules available	S U	S U	X	S U	S U	X	X	X	S U	S U	X	X
5 Trampoline - safety rules available	S U	S U	X	S U	S U	X	X	X	S U	S U	X	X

1980

668

	Gym	Gym	Pool	Wrest Room	Rhythm Room	Wt Room	Girls Locker	Boys Locker	Storage	Hall	Fields & Courts	Oth
6. Proper procedures have been formulated for emptying the room of pupils and taking adequate precautions in case of emergencies	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
7.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
8. Evaluation for the total rating for E - PERSONAL SAFETY	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
F. PLUMBING												
1. Water fountains - no broken, sharp edges, etc.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
2. Whirlpool baths	X	X	X	X	X	S U	S U	S U	X	X	X	X
3. Hot steam pipes - not exposed	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
4. Main shower control - enclosed	X	X	X	X	X	X	S U	S U	S U	X	X	S U
5. Rest room facilities - condition of	X	X	X	X	X	X	S U	S U	X	S U	S U	S U
6. Swim pool - general cleanliness	X	X	S U	X	X	X	X	X	S U	X	X	X
7. Chlorine storage	X	X	S U	X	X	X	X	X	S U	X	X	X
8. Drains open	X	X	S U	X	X	X	X	X	X	X	X	X
9. Tile not broken	X	X	S U	X	X	X	X	X	X	X	X	X
10. Vacuum - available	X	X	S U	X	X	X	X	X	X	X	X	X
11.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
12. Evaluation for the total rating for - F - PLUMBING	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
G. SURFACES												
1. Condition of floors - check floor plates, stage, etc.	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
2. Condition of grounds	X	X	X	X	X	X	X	X	X	X	S U	X
3. Condition of track	X	X	X	X	X	X	X	X	S U	X	S U	X
runways	X	X	X	X	X	X	X	X	X	X	S U	X
highjump blacktop	X	X	X	X	X	X	X	X	X	X	S U	X
shotput circle	X	X	X	X	X	X	X	X	X	X	S U	X
disc circles	X	X	X	X	X	X	X	X	X	X	S U	X
4. Condition of tennis courts	X	X	X	X	X	X	X	X	X	X	S U	X
5. Condition of walls	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
6. Walls are clear of objects that might fall or be unsafe obstructions	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
7. Gym dividers - condition of curtain or folding door	S U	S U	X	X	X	X	X	X	X	X	X	X
8. Crash pads on walls - should be in wrestling room and under baskets	S U	S U	X	S U	X	X	X	X	X	X	X	X
9. Conditions of mirrors	X	X	X	S U	S U	S U	S U	S U	X	X	X	S U

1981

	Gym	Gym	Pool	Wrest Room	Rhythm Room	Wt Room	Girls Locker	Boys Locker	Storage	Hall	Fields & Courts	Off-
10 Condition of windows	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
11 Condition of ceiling	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	X	S U
12 Condition of fences, wire backstops	X	X	X	X	X	X	X	X	X	X	S U	X
13 Condition of tennis rebound board	X	X	X	X	X	X	X	X	X	X	S U	X
14 Condition and safety of archery range	S U	X	X	X	X	X	X	X	X	X	S U	X
15 Condition of wire cages	X	X	S U	S U	S U	S U	S U	S U	S U	X	S U	S U
16	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
17	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U
18 Evaluation for the total rating for G - SURFACES	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U	S U

SECONDARY PHYSICAL EDUCATION ATHLETIC SAFETY INSPECTION

School ______________________ Date ______________________

Inspected By ______________________

AREAS NEEDING CORRECTION

Code No.	Area	Recommendations
Example: G — 1	B-Gym	Boards are warped — southwest corner

SCIENCE LABORATORY SAFETY CHECK LIST

Circle appropriate code symbol

A. Two unobstructed exits from laboratory .... S U NA

B. Laboratory Entrance

- 1. Wide enough to allow wheelchair to pass through .... S U NA
- 2. The door has a window with unobstructed view from the outside .. S U NA
- 3. The door latch is such that the door can be opened when slight force is applied from inside .... S U NA
- 4. Door cannot be locked from the inside .... S U NA

C. Room Emergency Center
The wall next to the door on the side opposite the hinge should be considered the room emergency center

- 1. Light switches for all areas of the room .... S U NA
- 2. Clearly labeled fire extinguisher .... S U NA
- 3. Room evacuation diagram .... S U NA
- 4. Master service cutoff controls
  - Water .... S U NA
  - Gas .... S U NA
  - Electricity .... S U NA
- 5. Emergency telephone numbers .... S U NA
- 6. First Aid Kit .... S U NA
- 7. Inspection record chart for all safety equipment .... S U NA
- 8. Spill control package .... S U NA

D. Eye wash fountain operational .... S U NA

E. Safety shower operational .... S U NA

F. Blanket on shelf .... S U NA

G. Sand bucket on floor .... S U NA

H. Fume Hood

- 1. Air flow sufficient to remove hazardous vapors and smoke from around the users and others .... S U NA
- 2. Exhaust vents exit the building .... S U NA
- 3. Ducts not corroded or plugged with dirt .... S U NA

I. Laboratory Stations

- 1. Lab stations permanently installed .... S U NA
- 2. Controls for gas and electricity located on the front panel of table S U NA
- 3. Table tops constructed of non-combustible material .... S U NA
- 4. No laboratory stools in work area .... S U NA
- 5. Station height is appropriate for the student .... S U NA
- 6. Adequate passing aisle around each table .... S U NA
- 7. Electrical outlets grounded according to local or state codes ..... S U NA

J. Storage Area

- 1. Preparation and storage room separate from laboratory .... S U NA
- 2. Storage room door cannot be locked from inside and has a window looking into lab .... S U NA
- 3. Storage room should have a door to the corridor or to the outside of the building with proper locks .... S U NA
- 4. Vented safety cabinets meeting NFPA specifications provide for each group of hazardous substances .... S U NA
- 5. Light switch at storeroom door and room well lighted and vented .. S U NA
- 6. If laboratory refrigerator is needed it should be explosion proof or explosion safe, depending on where it is used .... S U NA

K. Room lighting adequate in laboratory .... S U NA

L. Room ventilation adequate in laboratory .... S U NA

M. Number of students assigned to laboratory does not exceed recommended safe capacity .... S U NA

N. General Housekeeping .... S U NA

O. Compressed gases properly anchored .... S U NA

P. Chemical Storage

- 1. Containers properly labeled .... S U NA
- 2. Labels properly dated .... S U NA
- 3. Condition of chemical containers .... S U NA
- 4. Earthenware waste jars provided for each station .... S U NA
- 5. White phosphorous stored under water .... S U NA
- 6. Alkaline metals stored under kerosene .... S U NA
- 7. Large bottles of chemicals stored near floor on lower shelves ..... S U NA
- 8. Guard rail on front of shelves .... S U NA
- 9. Oxidizers stored separately .... S U NA
- 10. Flammable materials in safety cabinet .... S U NA

Q. Explosion Shield available for use .... S U NA

RECOMMENDATIONS

School ______________________ Room ______________________ Date ______________________

Teacher ______________________ Inspected By ______________________

Code No.	

APPENDICES

A. REFERENCES

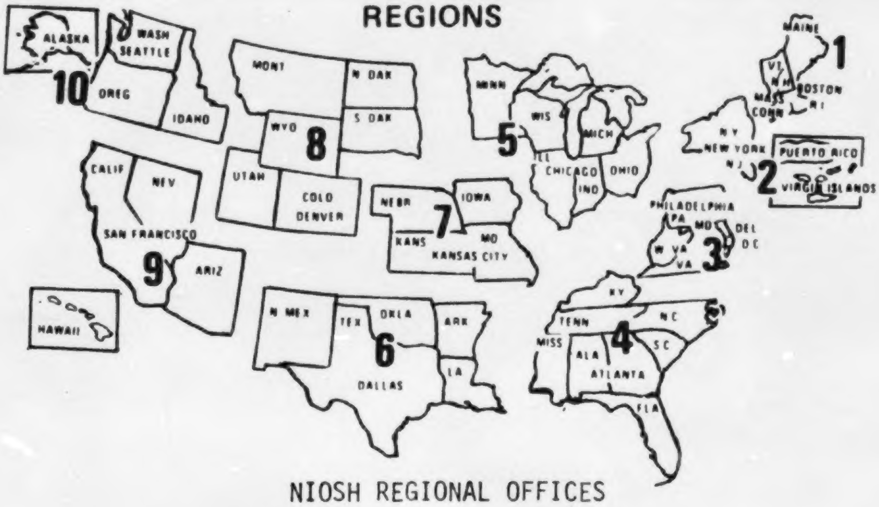
B. BIBLIOGRAPHY

C. ORGANIZATIONS

APPENDIX A--REFERENCES

NIOSH AND OSHA REGIONAL OFFICES

The following pages list NIOSH and OSHA regional offices. Either of these facilities serving the state can provide information on the Occupational Safety and Health Act including questions on standards interpretations, voluntary compliance information, copies of the OSHA Standards, OSH Act, Employee Rights Posting Notice, and other OSHA publications.


REGIONS
ALASKA
WASH
SEATTLE
10
OREG
IDAHO
MONT
N DAK
S DAK
WYO
8
UTAH
COLO
DENVER
CALIF
NEV
SAN FRANCISCO
9
ARIZ
HAWAII
NEBR
IOWA
7
KANS
MO
KANSAS CITY
N MEX
TEX
OKLA
ARK
6
DALLAS
LA
MINN
WIS
5
ILL
CHICAGO
MICH
IND
OHIO
MAINE
1
VT
N H
BOSTON
MASS
CONN
R I
N Y
NEW YORK
N J
PUERTO RICO
2
VIRGIN ISLANDS
PHILADELPHIA
PA
MD
DEL
DC
W VA
VA
3
KY
TENN
N C
MISS
4
S C
ALA
ATLANTA
FLA

NIOSH REGIONAL OFFICES

DHEW, Region I
JFK Fed. Bldg.
Room 1401
Boston, Mass. 02203
617/223-6668

DHEW, Region II
26 Fed. Plaza
Room 3300
New York, N.Y. 10007
212/264-2485

DHEW, Region III
P.O. Box 13716
Philadelphia, PA 19101
215/596-6716

DHEW, Region IV
101 Marietta Tower
Atlanta, GA 30323
404/221-2396

DHEW, Region V
300 S. Wacker Dr.
33rd Floor
Chicago, IL 60606
312/886-3651

DHEW, Region VI
1200 Main Tower Bldg.
Dallas, Texas 75202
214/655-3081

DHEW, Region VII
601 E. 12th St.
5th Floor West
Kansas City, MO 64106
816/374-5332

DHEW, Region VIII
11037 Federal Bldg.
Denver, Colo. 80294
303/837-3979

DHEW, Region IX
50 United Nation Plaza
Room 231
San Francisco, CA 94102
415/556-3781

DHEW, Region X
1321 Second Ave.,
Mail Stop 502
Seattle, Wash. 98101
206/442-0530

OSHA REGIONAL OFFICES

REGION I

U.S. Department of Labor
Occupational Safety & Health Adm.
JFK Building, Room 1804
Boston, Mass. 02203
617/223-6712/3

REGION II

U.S. Department of Labor
Occupational Safety & Health Adm.
1515 Broadway (1 Astor Plaza)
Room 3445
New York, New York 10036
212/971-5941/2

REGION III

U.S. Department of Labor
Occupational Safety and Health Adm.
15220 Gateway Center
3535 Market Street
Philadelphia, Penn. 19104
215/596-1201

REGION IV

U.S. Department of Labor
Occupational Safety & Health Adm.
1375 Peachtree Street, N.E.
Suite 587
Atlanta, Georgia 30309
404/526-3573 or 2281/2

REGION V

U.S. Department of Labor
Occupational Safety & Health Adm.
230 S. Dearborn, 32nd Floor
Chicago, Illinois 60604
312/353-4716/7

REGION VI

U.S. Department of Labor
Occupational Safety & Health Adm.
555 Griffin Square Building,
Room 602
Dallas, Texas 75202
214/749-2477/8/9 or 2567

REGION VII

U.S. Dept of Labor
Occupational Safety & Health Adm.
Federal Bldg., Room 3000
911 Walnut Street
Kansas City, Mo. 64106
816/374-5861

REGION VIII

U.S. Department of Labor
Occupational Safety & Health Adm.
Federal Bldg., Room 15010
1961 Stout Street
Denver, Colo. 80202
303/837-3883

REGION IX

U.S. Department of Labor
Occupational Safety & Health Adm.
9470 Federal Bldg.
450 Golden Gate Ave.
P. O. Box 36017
San Francisco, California 94102
415/556-0584

REGION X

U.S. Department of Labor
Occupational Safety & Health Adm.
6003 Federal Office Building
909 First Ave.
Seattle, Washington 98174
206/442-5930

NIOSH AND OSHA OFFICES (CONTINUED)

U.S. Consumer Product Safety Commission
Kansas City Regional Office
Kansas City, MO 64105

U.S. Department of Health, Education, and Welfare
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Division of Training & Manpower Development Branch
Cincinnati, OH 45226

U.S. Department of Labor
Occupational Safety and Health Administration
Wichita, KS 67202

Kansas Department of Health and Environment
Division of Environment
Bureau of Environmental Sanitation
Topeka, KS 66620

Kansas Department of Human Resources
Labor-Management Relations and Employment Standards
Topeka, KS 66612

Kansas Association for School Health
Topeka, KS

Wichita-Sedgwick County Emergency Medical Services
Wichita, KS

Wichita-Sedgwick County Department of Health
Wichita, KS

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HEW Publication No. (NIOSH) 76-113

Health and Safety Guide for Auto Repair and Body Shops
HEW Publications No. (NIOSH) 75-136

Health and Safety Guide for Concrete Products Industry
HEW Publication No. (NIOSH) 75-163

Health and Safety Guide for Construction and Related Machinery Manufacturers
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Health and Safety Guide for Eating and Drinking Places
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Health and Safety Guide for Farm and Garden Machinery and Equipment Manufacturers
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Health and Safety Guide for Fluid Milk Processors
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Health and Safety Guide for Food Processors
HEW Publication No. (NIOSH) 75-166

Health and Safety Guide for Grocery Stores
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APPENDIX C--ORGANIZATIONS

The following organizations, comprised of professional associations and manufacturers of equipment and supplies, have submitted material to be reviewed by the writing teams of this handbook. Their contributions to our endeavors are greatly appreciated. Their enthusiastic response is indicative of their concern for the health and safety of pupils, school personnel, and citizens in the public sector.

A. B. Dick Company, 5700 West Touhy Avenue, Chicago, IL 60648
Ablah Hotel Supply Corp., 800 E. 11th St., Wichita, Kansas 67214.
Addressograph Multigraph Corp., 1200 Babbitt Road, Cleveland, OH 44117
Aget Manufacturing Company, Adrian, MI 49221
Airco Welding Products, P.O. Box 486, Union, NJ 07083
American Mason Safety Tread Company, P.O. Box 310, Lowell, ME 01583
American National Standards Institute, Inc., 1430 Broadway, NY 10018
American Optical Corporation, 14 Mechanic St., Southbridge, MA 01550
American School and Community Safety Association, 1201 Sixteenth St., N.W. Washington, D.C. 20036
American Society of Safety Engineers, 850 Busse Highway, Park Ridge, IL 60068
American Technology, 2340 Susquehanna Street, Harrisburg, PA 17110
American Welding Society, 2501 Northwest 7th St., Miami, FL 33125
AMMCO-Tools, Inc. 211 Commonwealth Avenue, North Chicago, IL 60064
AMPCO Metal, P.O. Box 37014, Cincinnati, OH 45222
APEX Safety Products, P.O. Box 250, Sanford, NC 27330
Applied Ultra Violet Tech., 1301 E. Lincoln Avenue, Goshen, In 46526
ARCAIR, P.O. Box 406, Lancaster, OH 43130
Armstrong Brothers Tool Company, 5200-5300 W. Armstrong Ave., Chicago, IL 60646
Armstrong Cork Company, West Liberty St., Lancaster, PA 17540
ARTCO Corporation, Penn Avenue, Hatfield, PA 19440
Atlantic India Rubber Company, 571 W. Polk St., Chicago, IL 60607

Baker (J.T.) Chemical Company, 222 Red School Lane, Phillipsburg, NJ 08865
Baldor Electric Company, Fort Smith, AR 72902
Bausch & Long, Box 450, Dept. 3506-B, Rochester, NY 14613
Binks Mfg. Company, P.O. Box 66090, Chicago, IL 60666
Black & Decker Mfg. Company, Towson, MD 21204
Blu-Ray, Inc., 747 Westbrook Road, Essex, CT 06426
Bona Venture Supply Company, 17 Village Square, Hazelwood, MO 63042
Bouton Company (H.L.) Buzzards Bay, MA 02532
C.W. Brabender Instruments Inc., 50 East Wesley St., P.O. Box 2127 South Hackensack, NJ 07606

Bradley Corp. W142 N9101 Fountain Blvd., Menomonee Falls, WI 53051.
Brett-Guard Div. Foredom Electric Company, RR #6 Bethel, CT 06801.
Bridgeport Textron Machines Division, 500 Lindley St., Bridgeport, CT 06606.
Brilliant Abrasive Company, 4330 Clary Blvd., Kansas City, MO 64130.
Brodhead-Garrett Company, 4560 East 71st St., Cleveland, OH 44105.
Bruning (Charles) Company, Div. A-M Corp., 1800 West Central, Mount Prospect, IL 60056.

Cadillac Plastic & Chemical Co., Box 810, Detroit, MI 48232.
CESCO Safety Products, 100 East 16th St., Kansas City, MO 64108.
Challenge Machinery Company, P.O. Box 326, Grand Haven, MI 49417.
Coilhose Pneumatics, 201 Pond Ave., Middlesex, NJ 08846.
Columbian Vise & Mfg. Company, 9021 Bessemer Ave., Cleveland, OH 44104.
Columbus McKinnon Corp., Fremont Avenue, Tonawanda, NY 14150. (CM Chain Divison)
Compugraphic 80 Industrial Way, Wilmington, MA 01887.
Cooperative Extension Service, K.S.U., Manhattan, Kansas 66506.

D & M Guard Company, 889 Military Road, Buffalo, NY 14217.
Delaware Valley Safeguards Company, Leesport, PA 19533
Di-Acro Houdaille, Houdaille Industrices, Inc., Lake City, MN 55041.
Dustvent, Inc., 110 West Fay St., Addison, IL 60101.
Dyna Technology, Inc., P.O. Box 3263, Sioux City, IA 51102.
DAKE Corporation, Grand Haven, MI 49417.

Eagle Mfg. Company, Main Street, Wellsburg, WV 26070.
Eastern Safety Equipment, 45-17 Pearson St., Long Island City, NY 11101.
Educational Machinery Corp., Box 146, Glenville Station, Greenwich, CT 06830.
Ellwood Safety Appliance Co., Gray Building, 225 Sixth St., Ellwood City, PA 16117.

Energy Concepts, Inc., 3956 West Belmont Ave., Chicago, IL 60618.
Equipment Company of America, 1075 Hialeah Dr., Hialeah, FL 33010
Equipto (Gary DeWitt) 225 South Highland, Aurora, IL 60507.
ESB Inc., Safety Products Division, 2nd & Washington Street, Reading, PA 19603.

Falcon Safety Products, Inc., 1065 Bristol Rd., Mountainside, NJ 07092.
Fibre-Metal Products Co., Concordville, PA 19331.
Frank Paxton Lumber Co., 6311 St. John, Kansas City, MO 64123.
Frommelt Industries, Inc., 465 Huff St., Dubuque, IA 52001.

General Scientific Equipment Co., P.O. Box 27309, Philadelphia, PA 19150.
Glendale Optical Company, Inc., 130 Crossways Park Drive, Woodbury, Long Island, NY 11797.
Graymark International Inc., P.O. Box 17359, Irvine, CA 92713.
Grinding Wheel Institute, 712 Lakewood Center, North Cleveland, OH 44107.
Hamilton Beach, Washington, North Carolina 27889.

Hammond Machinery Builders, Inc. 1604 Douglas Ave., Kalamazoo, MI 49007.
Hand Tools Institute, 707 Westchester Ave., White Plains, NY 10604.
Harper Trucks, Inc., P.O. Box 33, Wichita, KS 67201.
HAWS Drinking Faucet Company, 4th and Page Streets, Berkeley, CA 94710.
Hickok Teaching Systems Inc., Wheeling Avenue, Wobur, MA 01801.
Homestead Industries, Box 348, Corapolis, PA 15108.
Human Society of The United States, Washington, D.C. 20037.

Industrial Commission of Ohio, 700 West 3rd Ave., Columbus, OH 43212.
Ingersoll-Rand (Miller Falls Div.) South Deerfield, MA 01373.
Ingersoll-Rand Company (Prot Tool Div.) 2600 E. Nutwood Avenue,
Fulleton, CA 92631.
Institute of Gas Technology, 3424 S. State St., Chicago, IL 60544.

Justrite Manufacturing Company, 2354 Dempster St., Des Plaines, IL 60016.

Kellogg-American, Inc., 565 Cedar Way, Oakmont, PA 15139.
Kelvin Electronics, Inc., 1900 New Highway, Farmingdale, NY 11735.
Ken Cook Company, Automated Teaching, 9929 West Silver Spring Road,
Milwaukee, WI 53225.
Kidde Belleville (Walter) 675 Main Street, Belleville, NJ 07109.

Lab-Line Instruments, Inc., 15th & Bloomingdale Ave., Melrose Park,
IL 60160.
Lab Safety Supply Company, P.O. Box 1368, 3430 Palmer Drive, Janesville,
WI 53545.
K.O. Lee Company, P.O. Box 970, 200 South Harrison, Aberdeen, SD 57401.
Lincoln Electric Company, 22801 St. Clair Ave., Cleveland, OH 44117.
Link Electric & Safety Control, P.O. Box 100, Kingston Springs, IN 37082.
Loge/Robertson Photo-Mechanic, 250 Willie Road, Des Plains, IL 60018.
Lowel-Light Mfg. Inc., 421 West 54th St., New York, NY 10019.

McEnglevan Heat Treating Mfg. Company, P.O. Box 31, Danville, IL 61832.
McGill Mfg. Company, Inc., Valparaiso, IN 46383.
McKnight & McKnight Publishing Co., Dept. B-3, Bloomington, IL 61701.
McNeil Akron, Inc., 96 East Crosier St., Akron, OH 74311.
Macy's, 121 S. Broadway, Wichita, Kansas 67202.
MacMillan Arts & Crafts, Inc., 9645 Gerwig Land, Columbia, MD 21046.
Manufacturers Brush Company, 12501 Elmwood Ave., Cleveland, OH 44111.
Marion Health & Safety Inc., 9233 Ward Parkway, Kansas City, MO 64114.
Marketing Matheson, P.O. Box E, Lyndhurst, NJ 07071.
Mathewson Gas Products, 932 Paterson Plank Road, P.O. Box 85, East
Rutherford, NJ 07073.
Megatech Corp., 29 Cook Street, Billerica, MA 01866.
Met-L-Chek Company, Inc., P.O. Box 5427, Inglewood, CA 90310.
Michael Business Machines, 145 West 45th St., New York, NY 10036.
Mid-Continent Fire & Safety, Inc., 1641 N. Mosley, Wichita, KS 67214.
Midwest Sewing Center, 111 Pattie, Wichita, Kansas 67211.
Miller Equipment Divison, ESB Inc., Franklin, PA 16323.
Milwaukee Electric Tool Corp., 13135 W. Lisbon Road, Brookfield, WI 53005.
Modern School Supplies, Inc., P.O. Box 956, Hartford, CT 06101.
Morse Mfg. Company, Inc., 780 West Manlius St., East Syracuse, NY 13057.

National Electrical Contractors Association, Kansas Chapter, Wichita,
KS.
National Fire Protection Association, 470 Atlantic Ave., Boston,
MA 02210.
National Society for Prevention of Blindness, 79 Madison Ave.,
New York, NY
Newbury Industries, Inc., 10975 Kinsman Road, Newbury, OH 44065.
Nisson Corp., 930 27th Avenue, S.W., P.O. Box 1270, Cedar Rapids,
IA 52406.
Norton Company, 2000 Plainfield Pike, Cranston, RI 02920.
NuArc Company, Inc., 4110 West Grand Ave., Chicago, IL 60651.

Occupational Safety & Health Administration, 216 N. Waco, Wichita, KS
67202.

Paragon Industries, Inc., Box 10133, Dallas, TX 75207.
Pittsburg Industrial Teachers Service Co., P.O. Box 26, Pittsburg,
KS 66762.
Photo Materials Company, 500 N. Spaulding Ave., Chicago, IL 60624.
Positive Safety Manufacturing Co., 34990 Melinz Parkway, Eastlake,
OH 44094.
Power Tool Institute, Inc., 5101 Toll View Drive, Rolling Meadows, IL.
Powermatic Houdaille, Inc., McMinnville, TN 37110.
Protectoseal Company, 225 West Foster Ave., Bensenville,IL 60106
Proto Professional Tools, 2600 E. Nutwood Ave., Fullerton, CA 92631.
Pitsco Inc., Pittsburg Industrial Teachers Service Companu, P.O. Box
26, Pittsburg, KS 66762.

Radatron Corp., 2424 Niagara Falls Blvd., N. Tonawanda, NY 14120.
Refrigeration Service Engineers Society, Wichita, KS.
REGO Company, 4201 West Peterson Ave., Chicago, IL 60646.
Rexarc Inc., P.O. Box 47, W. Alexandria, OH 45381.
Ridge Tool Company, 400 Clark Street, Elyria, OH 45381.
Robertson Photo-Mechanix, Inc., 1250 Touhy Ave., Elk Grove Village,
IL 60007.
Rockford Safety Equipment Company, P.O. Box 5166, 4620 Hydraulic Road,
Rockford, IL 61125.
Rockwell International, 400 N. Lexington Ave., Pittsburg, PA 15208.
Roper Whitney, Inc., 2833 Huffman Blvd., Rockford, IL 61101.
Rose Manufacturing Company, 2250 Tejon St., Englewood, CO 80110.

Safeguard Manufacturing Company, Pomperaug Ave., Woodbury, CT 06798.
Salisburg & Company, 7520 N. Long Ave., P.O. Box 1080, Skokie, IL 60077.
School Tools, Inc., 901 East 79th Street, Minneapolis, MN 55420.
Screen Printing & Drying Machine Company, 4434 Olive St., St. Louis,
MO 63108.
Seal, Inc., Naugatuck, CN 06770
Sellstrom Mfg. Company, Sellstrom Industrial Park, Palatine, IL 60067
Shawnee Mission, Director of Practical Arts, 6649 Lamar, Shawnee
Mission, KS 66202.

Singer Safety Products, 444 North Lake Shore Drive, Chicago, IL 60611.
Sioux Tools Inc., 2901 Floyd Blvd., Sioux City, IA 51102.
Snap-on Tools Inc., Kenosha, WI 53140.
Society of Plastics Industry, Inc., 355 Lexington Ave., New York, NY 10017.
South Bend Lathe, Inc., 400 West Sample St., South Bend, IN 46621.
Stanley Tools, New Britain, CN 06050.
SSP Brown Camera, Inc., 610 E. Judd St., P.O. Box 471, Woodstock, IL 60098.
Stark Lumber Company, Fairfax Industrial District, Kansas City, KS 66115.
Steel Grip Safety Apparel Company, 700 Garfield St., Danville, IL 61832.
Sterling Extruder Corp., 901 Durhan Ave., S. Plainfield, NJ 07080.
Surty Manufacturing Company, Route #2, Gleason, WI 54435.
Society of Plastics Engineers, Inc., 656 West Putnam Ave., Greenwich, CT 06830.
Three M (3M) St. Paul, MN 55101.
Toolmark Company, 6840 Shingle Creek Parkway, Minneapolis, MN 55430.
Torit Division, Donaldson Co., Inc., Box 3217 St. Paul, MN 55165.

Unimax Switch Corporation, Ives Road, Wallingford, CT 06492.
United Air Specialists, Inc., 6665 Creek Road, Cincinnati, OH 45242.
United HEW - NIOSH - 4676 Columbia Parkway, Cincinnati, OH 45226.
U.S. Mat and Rubber Company, Inc., 93 Pleasant St., Brockton, MA 02401.
U.S. Safety Service Company, 1535 Walnut St., Box 1237, Kansas City, MO 64141.
Uniweld Products, Inc., P.O. Box 8427, Ft. Lauderdale, FL 33310.
Universal Grinding Wheel Company, Inc., 712 Lakewood Center North, Cleveland, OH 44107.
University of Northern Iowa, Cedar Falls, IA 50613.

V and E Manufacturing Company, 766 S. Fair Oaks Ave., Pasadena, CA 91105.
Victor Equipment Company, P.O. Box 1007, Denton, TX 76201.
Vivitar, 1630 Stewart Street, Santa Monica, CA 90406.

Weller, Division of Cooper Industries, 100 Wellco Road, Easton, PA 18042.
Wells & Sons, North on U.S. 131, Three Rivers, MI 49093.
Western Drinking Fountains (Safety Div.) P.O. Box 47, Glen Riddle, PA 19037.
Wilton Corporation, Machinery Division, 2400 East Devon Ave., Des Plaines, IL 60018.